ARMED FORCES CHEMICAL JOURNAL

—U. S. Army Photo

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POLICY

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

COVER PHOTO

This awesome yet beautiful picture shows cropped portion of the JUPITER, intermediate range ballistic missile developed by the Army, as it lifts from its launching pad in a successful flight at Cape Canaveral, Florida. Both the JUPITER and the THOR, intermediate range ballistic missile developed by the Air Force, have been approved by the Department of Defense for production.

Although this striking Army photo has already been publicized to some extent, its use here well serves the Journal's purpose. It can be viewed as a sort of symbol of the new science of rocketry and the hope it gives to man for ultimate mastery of outer space. But also, the ballistic missile is significant for A.F.C.A. as a veritable embodiment of many new achievements of modern chemistry—heat resistant materials—solid state—chemical fuels of previously undreamed of power — et cetera, et cetera!

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ARMED FORCES CHEMICAL ASSOCIATION

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WASHINGTON 6, D.C.

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The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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BALTIMORE CHAPTER HEARS TALK ON ROCKET RESEARCH

EDGEWOOD, MD.—Warren W. Berning, chief of the guidance control branch, Ballistics Research Laboratories, Aberdeen Proving Ground, addressed the Baltimore chapter, Armed Forces Chemical Association at a dinner-meeting held here last November. His talk dealt with rocket research and the U.S. participation in the International Geophysical Year.

A graduate of the University of Cincinnati, Mr. Berning has done graduate work in physics at the California Institute of Technology and John Hopkins University. He served four years in the United States and Britain during World War II as a meteorologist.

Mr. Berning has participated in various guided missile nuclear weapons and rocket research programs. Since 1945 he has served as a member of the technical panel on rocketry and the special committee for IGY of the National Academy of Sciences.

—U. S. Army Photo

Mr. Warren W. Berning (right), guest speaker at a dinner-meeting of the Baltimore chapter, Armed Forces Chemical Association, held at the Army Chemical Center, explains some points about the model Navy Vanguard satellite to, (left to right): Mr. William Sheltmire of the Olin Mathieson Chemical Corporation; Colonel Harold Walmsley, post commander; Lt. Colonel James A. Richardson; and Dr. Robert Patrick, Pemco Corporation.

MR. R. L. MURRAY OF HOOKER RECEIVES ACHIEVEMENT AWARD

"I hope and believe that the very fact that sputnik now circles overhead will stimulate our own government's defense developments and at the same time encourage more students to embrace science as a career." This was stated by Mr. R. Lindley Murray, board chairman of Hooker Electrochemical Co., Niagara Falls, N.Y., when he was honored recently as the recipient of the Sixth Annual Professional Achievement Award of the Western New York Section, American Institute of Chemical Engineers. The award was made at a dinner held October 17, 1957, at the Sheraton-Brock Hotel, Niagara Falls, Ont., where approximately 175 guests applauded the selection of Mr. Murray.

Choosing as his title "Panorama of a Chemical Company as Viewed by a Chemical Engineer," Mr. Murray, who has spent 43 years in the chemical industry, outlined the responsibilities of the many important departments now necessary in a major chemical firm.

In connection with his comments about Russia's earth satellite, Mr. Murray said, "Our chemical industry will play a vital part in the development and production of components of the high energy fuels required for propulsion of rockets and missiles."

MR. GEORGE W. MERCK

Mr. George W. Merck, who was chairman of the Board of Directors of Merck & Co., Inc., Rahway, N.J., one of the nation's largest manufacturers of chemical and pharmaceutical products, died suddenly of a cerebral hemorrhage on November 9, 1957 at his home, Eagleridge Farms, West Orange, N.J. He was 63.

Mr. Merck was born in New York City, March 29, 1894, the son of George and Friedrike (Schenck) Merck. A graduate of Harvard University, class of 1915, where he received the A.B. degree, Mr. Merck subsequently joined Merck & Co., which had been started by his father in 1889. He succeeded his father as president in 1925 and became chairman of the Board of Directors in April, 1949.

A firm believer in the value of scientific research to industry and to humanity, Mr. Merck was instrumental in establishing new and modern research laboratories at Rahway in 1933. He was also influential in the company's establishing in 1946 a fund of $100,000 with the National Research Council (since supplemented by additional grants totaling $225,000) for postdoctorate fellowships in the natural sciences.

Mr. Merck became a member of the Chemical Advisory Committee of the Munitions Board in 1939 and served as chairman from 1949 until the Spring of 1951, when the committee was dissolved. He was appointed director of War Research Service when that agency was established in 1942 to take charge of all aspects of biological warfare research and development. In 1944 the War Department assumed full responsibility in this field, and the United States Biological Warfare Committee was established with Mr. Merck as chairman. At the same time, he was appointed special consultant on biological warfare to the Secretary of War.

In 1946 Mr. Merck received the Medal for Merit for exceptionally meritorious conduct in the performance of outstanding services to the United States.

Mr. Merck had been awarded honorary doctorate degrees in science, pharmacy, engineering and Laws from eight colleges and universities and was a member of many civic and scientific organizations.

BECCO HONORED FOR ITS SUPPORT OF MILITARY RESERVE PROGRAM

Recognition of the active support given the military reserve program by Becco Chemical Division, Food Machinery and Chemical Corporation, Buffalo, N.Y., has been given by the Department of Defense. At a service in Buffalo on October 22, Major-General R. A. Bell, Commanding General of the New York Military District, presented to Becco's president, Frederick A. Gilbert, an engraved certificate commending the company for its cooperation in encouraging the Reserve program, and also a pennant which can be flown from the Becco flagpole.

Becco's employees who are members of the Armed Forces Reserve are released from their duties at Becco as may be necessary to attend military training periods. Such training time is in addition to the employees' regular annual vacation, and any discrepancy between an employee's military pay and his regular earnings is made good by the company. Twenty-five Becco employees are presently participating in the program.

FRANCE HONORS GEN. McAULIFFE

General Anthony C. McAuliffe, vice president in charge of engineering and construction of the American Cyanamid Company, in a recent ceremony held at the French Consulate in New York City, received the Legion of Honor medal with rank of Commander and the Croix de Guerre with Palm, in recognition of his service to France in World War II. Shown in the picture, above making the presentation is Mr. Herve Alphand, French Ambassador to the United States.

NEW CHEMICAL CORPS MAJOR

James Howell Smith has been promoted to Major in the Chemical Corps, United States Army Reserve. Major Smith is attached to the 5001 Research and Development Group, Fort Wayne, Detroit, Mich. Major Smith represents the Chemicals-Pigments-Metals Division of the Glidden Company in the Detroit Area.

ANONYMOUS GIFT OF $1,000,000 FOR CHEMISTRY TO UNIV. OF PENN.

Announcement of an initial gift of $1,000,000 by an anonymous donor toward a $1,650,000 building program to further basic research and teaching in chemistry at the University of Pennsylvania was announced at a Midday Club luncheon meeting in Philadelphia on November 5.

Presiding was Dr. William A. LaLande, Jr., vice president of Pennsalt Chemicals Corporation and chairman of the program seeking the balance of $650,000 for new chemistry instruction facilities. Dr. LaLande is a member of A.F.C.A.

WILMINGTON HEARS TALK ON AIR FORCE MATERIALS NEEDS

Wilmington Chapter, at its annual meeting on December 3, was addressed by Mr. E. M. Glass, Technical Director of the Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. Mr. Glass discussed materials requirements and stressed the importance of cooperation between industry and the Armed Services.

Chapter officers for the forthcoming year were elected as follows: Mr. Henry T. Clark, Atlas Powder Co., President; Mr. William G. Kinsinger, Hercules Powder Co., first Vice-President; Mr. William W. Hess, E. I. du Pont de Nemours & Co., second Vice-President; and Mr. William J. Taylor, Jr., Atlas Powder Co., Secretary-Treasurer.

GEN. CREASY HONORED AT NEW YORK CHAPTER DINNER

Major-General William M. Creasy, Chief Chemical Officer of the Army, was guest speaker at a testimonial dinner in his honor given by the New York Chapter of A.F.C.A., at Hotel Delmonico, New York City, on November 7. Mr. W. Ward Jackson, President of the Chapter, in introducing General Creasy as guest speaker, presented to him a testimonial scroll in appreciation of the help he has given to industry.

More than 300 members and guests of the New York Chapter, including a number from the Washington, D.C., area, attended. Among the specially honored guests were commanders or their representatives of Army, Navy, Air, and Coast Guard installations in the New York City area.

General Creasy in his address stated that the Army considers it must be prepared to engage in any type of war, limited or un-limited. He outlined and emphasized the importance of preparedness in the Chemical Corps' field, he named a number of current projects engaging the Corps and also stated that consideration is currently being given to the assignment to the Corps of procurement responsibility for all chemicals purchased for the Army. Excerpts from his address on page 8.

NEW ENGLAND CHAPTER HEARS TALK BY COL. W. J. ALLEN, JR.

Col. W. J. Allen, Jr., commanding officer of the Chemical Corps Engineering Command at Army Chemical Center, Maryland, was guest speaker on December 11, before a well-attended group of New England Chapter members, their wives and guests.

The facilities of the Officers' Club at the Naval Shipyard in Boston were made available for the dinner meeting.

Among the eighty or more persons who attended were twelve guests from the First Naval District, including the Commandant and the Commanding Officer of the Naval Shipyard and their wives, two officers from M.I.T. and two officers from Fort Devens.

Members spoke in praise of the interesting and ably presented description given by Colonel Allen of the mission, function and operation of the Engineering Command.

GEORGIA TECH CHAPTER PRESENTS BRONZE PLAQUE TO MRS. BROWN

The Georgia Tech. Student Chapter held its third annual meeting of the school year on November 25 primarily for the purpose of presenting an A.F.C.A. science teacher plaque award to Mrs. Annie Sue Brown, Curriculum Specialist in Science of the Atlanta School System. Mrs. Brown was the Chapter's candidate in competition this year for the A.F.C.A. $1000 cash award to an outstanding science teacher selected from among candidates named by the various chapters. The presentation of the plaque to Mrs. Brown for her selection as candidate was made by Mr. Woodrow J. Travis, Jr., President of the Chapter.

Among the distinguished guests present was Dr. Kenneth R. Williams, Deputy Superintendent, Atlanta Schools; Mr. George C. Griffin and Mr. John J. Pershing, Dean of Students, and Assistant, respectively, at Georgia Tech.

The program also included an address by Dr. Harold B. Friedman, chief chemist for the ZEP Mfg. Corp., in Atlanta, and Reserve Officer of the Chemical Corps. He spoke on the relationship of science and the science teacher, comparing conditions in Russia with those of the United States, and relating some of his own experiences in Russia.

DR. BUSH CHAIRMAN OF MERCK; MR. GEORGE PERKINS A DIRECTOR

Dr. Vannevar Bush, internationally known scientific figure, was elected chairman of the Board of Directors of Merck & Co., Inc., Rahway, N.J., on December 17, 1957.

A Merck director since 1949, Dr. Bush succeeds the late George W. Merck, who died last month.

Mr. George Perkins, recently United States permanent representative on the North Atlantic Treaty Organization (NATO) Council, was elected a director of the company.

Mr. Perkins returns to the Merck Board after an absence of nine years spent chiefly in Federal Government service. During World War II he served with the Chemical Warfare Service as a colonel. He was awarded the Legion of Merit for his contributions to development of chemical warfare operations.

AFCA OFFERS NEW AWARD FOR ENROLLING MEMBERS

As an incentive to members of A.F.C.A. to introduce new members, the Association awards a plaque to each member who causes ten new names to be added to the list.

At its December 16, 1957 meeting, the Executive Committee voted to make a second award to members who bring in an additional ten new members.

The second award will be a tie clasp and an AFCA membership key. This award will be accompanied by a letter of appreciation.

KUHN'S "NATO OF BRAINS" IDEA RECALLED BY AFCA MEMBERS

The idea of a scientific alliance among NATO countries to promote exchange of scientific and technical information as a bulwark for the free world was widely discussed and publicized in connection with the development of the program for the NATO Conference in Paris in December 1957 attended by President Eisenhower.

News of the plan to strengthen the scientific front of the Western World rang a familiar note for many members of A.F.C.A., particularly those of the Executive Committee and Board of Directors. They recalled that some months ago, under the title of "A NATO of Brains," Colonel Harry A. Kuhn, Retired, past-President of the Association, put forward just such an idea himself. He expressed such views at the meeting of the Board of Directors of A.F.C.A. in Washington last May. He had previously proposed it to the Executive Committee as a subject for consideration by the Association for a project program.

Colonel Kuhn expressed the view that a closer relationship among Western World scientists and facilitation of arrangements for cooperative effort by them would help the West to match or offset Soviet scientific progress. Word of Colonel Kuhn's views in this respect came to the attention of Mr. David Sentner, Hearst newspaper correspondent and author of a syndicated column entitled "Washington Window." In his column of March 4, 1957, discussing counter-espionage as a possible "new American secret weapon to stop Red Russia" he also alluded to Colonel Kuhn's idea, stating in part as follows:

"Another suggestion intriguing our Pentagon security engineers has come from Col. Harry Kuhn, former top specialist in the chemical warfare section of research and development during the war.

"Kuhn urges we create a NATO of technological skills among our Allies and ourselves as a countermeasure to the scientific surge inside the USSR . . ."

SCIENCE TEACHER PLAQUE AWARD MADE AT FT. McCLELLAN DINNER

—Official U.S. Army Photo

Father Reiner, of Cullman, Ala., Fort McClellan Chapter, nominee for the Association's 1957 cash award to an outstanding science teacher at the high school level, receives bronze plaque from Colonel Edwin Van Keuren, Retired, formerly Fort McClellan's Chapter President.

Ft. McClellan, Ala., Chapter reports a most successful annual dinner held last October on the Post at Remington Hall. The guest speaker was Mr. James D. Martin, President of the Martin Oil Co., Inc., of Gadsden, Ala. Speaking on "What made America Great," Mr. Martin stressed American freedoms and opportunities as individuals. Members observed that Mr. Martin's career gave credence to his speech. Born in Birmingham, Ala., Mr. Martin entered the Army in World War II as a private in 1941 and had risen to the grade of Major when discharged in 1946.

Another special feature of the annual dinner meeting was the presentation of the Armed Forces Chemical Association's Science Teacher plaque award to Father Charles Reiner of Saint Bernard Abbey, Cullman, Ala. This bronze plaque is now awarded to the various chapter selectees as outstanding science teachers nominated by chapters for the annual A.F.C.A. $1000 cash award made by National Headquarters of the Association.

The presentation to Father Reiner was made by Col. Edwin Van Keuren, Retired, former President of the Chapter and also a former director of the Association.

The "president's key" award was also made at the dinner to Colonel Cecil H. Wood who served as president of the Chapter, 1955-56.

FT. SHERIDAN SEEKS RELICS FOR HISTORICAL MUSEUM

Fort Sheridan, Illinois, planning soon to open an historical museum, is seeking historical relics relating to General Philip H. Sheridan, famous Union Cavalry commander of the Civil War, for whom the Post is named, and also relics of the 1880 period of U.S. history. Uniforms, books, pictures, weapons, maps or anything depicting the past history of the post are being sought.

Persons wishing to donate items for the museum are asked to contact Mr. Richard E. Puckett, Special Services Museum Director at Fort Sheridan, ID 2,5000, ext. 3131.

GENERAL AND MRS. AMOS A. FRIES

Mrs. Elizabeth C. Fries, wife of Major General Amos A. Fries, USA Retired, former chief of the Chemical Warfare Service (now the Chemical Corps), and honorary life member of A.F.C.A., died on November 18, 1957 at Walter Reed Hospital in Washington, D.C. She was 81.

General and Mrs. Fries celebrated their 58th wedding anniversary at a family party at their home in Washington, D. C., last August. They were married in Medford, Oregon, in 1899 following his graduation from West Point. General Fries' West Point sword was used to cut the cake in the anniversary celebration.

Mrs. Fries, who had been quite active until her last brief illness, had a wide acquaintance. She was a member of the Daughters of the American Revolution, The American Legion Auxiliary and the American Newspaper Women's Club.

The striking picture of General and Mrs. Fries, here presented, was taken not long ago following their attendance at a White House reception given by President and Mrs. Eisenhower.

GEN. CREASY ADDRESSES NEW YORK CHAPTER

(Discusses Importance of CBR warfare; Stresses Need for an Informed Public and Tells of Some New Tasks Assigned to Chemical Corps Including Development of Means for Radioactive Waste Disposal. The following is excerpted from Speech at Chapter Banquet at Hotel Delmonico, New York, N.Y., November 7, 1957.)

. . . Our national security policy has at its central aim the deterrence of communist expansion in whatever form it may take, to the end that it will not constitute a threat to the security of our nation. We must have the political, economic, and moral strength sufficient to induce the communist block to refrain from all forms of aggression against the Free World. And, the evidence of this strength must be so clear as to convince any potential enemy that aggression will not pay, and thereby create a foundation for a true world peace.

The elements of a sound national security program must include adequate provision for four things: deterrence of general war, deterrence of local aggression, defeat of local aggression, and if necessary, victory in general war conducive to a viable peace.

While we all work and pray for peace, we must not lose sight of the fact that we have been caught unprepared for war three times in forty years. In each case we have paid a high price for weakness and neglect. It is to be hoped that we have learned, at long last, that . . . the surest guarantee of peace is constant preparedness for war.

Required Scope of Preparedness

For what type of war should we be prepared? The Army's official position is that it must be prepared to engage in any type of war, both limited or unlimited, in any area of the world where it is in the interest of the United States to commit military forces. While the Army emphasizes the attainment of a fully effective capability to conduct atomic warfare, ground forces must be organized and equipped to retain a capability to win wars in which atomic weapons may not be used. It must be capable of applying force in varying degrees commensurate with the varying situation.

We cannot commit ourselves exclusively to any one type of weapon or any one type of warfare. We would be foolhardy to expect that any aggressor would be obliging enough to accommodate himself to the type of warfare most convenient to us. We . . . must examine all of the ways in which any enemy might attempt to challenge us and prepare ourselves accordingly.

You all know that I am concerned with a type of warfare which has not been employed in modern conflicts. You do not hear much about it in public discussions of national defense planning, and the average person has little knowledge of its characteristics and potentialities in the hands of an enemy. I am speaking, of course, of the types of weapons common to chemical and biological warfare, and the methods by which such munitions might be employed in conflict by an aggressor.

The public should know much more about this type of warfare. Such groups as yours here today can help in disseminating more knowledge about it . . . because these munitions have not been employed in recent wars this is no guarantee that we may not have to face them in any conflicts into which we may be drawn.

An unfriendly nation gauging our ability to defend ourselves and the rest of the Free World will be well aware of our strength in the nuclear field and will govern his plans accordingly. He also must be made aware of our ability to defend ourselves in the toxicological field should he be tempted to resort to the use of these munitions. And, it goes without saying, we must have such an ability.

We know that other nations are fully aware of the potentialities of gas and disease germs as a means of war. Not too many months ago Georgi Zuhkov, recently deposed as Soviet Defense Minister, declared before the 20th Congress of the Communist Party that "any new war will be characterized by mass use of air power, various types of rocket weapons, and various means of mass destruction such as atomic, thermonuclear, and chemical and biological weapons." That is a warning plain enough for all of us to see and it would be the height of folly not to govern ourselves accordingly. We can safely assume that chemical and biological weapons figure prominently in the Soviet Arsenal.

However, we have chosen to build a wall of mystery around these weapons which has worked to our detriment in building our defenses against them.

I became Chief Chemical Officer of the Army in 1954 and as such I have been charged with the responsibility of seeing that the Army Chemical Corps carries out its mission of providing the nation with the capability of coping with chemical, biological, and radiological warfare. This mission, as you know, is a broad one and includes not only the conduct of research and development in these fields, but the manufacture or procurement of the material so developed. The Corps also provides necessary training for the military services in the use of chemical, biological, and radiological warfare material. This mission is so broad that the Corps works not only for the Army, but for the Air Force and the Navy, and such non-military agencies as the Federal Civil Defense Administration and the United States Public Health Service. We work closely with the Medical Service and other technical services of the Army.

Need For Informing the Public

As part of my job in discharging these responsibilities, I have felt that I should. wherever, and whenever the opportunity arose, disseminate as much information as possible about weapons in our field so that our military services would be fully apprised of their potentialities in the hands of any enemy, and that plans for national defense would include these weapons as well as those of the atomic and other varieties.

I have also felt that the general public must be made fully aware of the existence of these methods of warfare and that it should know enough about their uses and effects to prepare it for the possibility that they may be used against us in any future war.

How well I have succeeded in my efforts, or not, I cannot say. I do know that there is still a tendency by many people to bury their heads in the sand at mention of chemical and biological warfare. This is the type of thinking in which an aggressor would like us to indulge. If carried far enough this attitude will leave us defenseless in a method of warfare which offers so many advantages to an enemy.

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NEW DEFENSE APPOINTMENTS

U. S. Army Photo
THE HONORABLE NEIL H. McELROY
Secretary of Defense

BIOGRAPHICAL sketches of Neil Hosler McElroy, the new Secretary of Defense, and of James Rhyne Killian, Jr., just recently appointed Scientific Adviser to The President, reveal some remarkable similarities in the careers of the two men. For instance, both are about the same age, 53; both completed their college education in Cambridge, Massachusetts, though at different institutions; both remained consistently with the organizations they joined as a means of livelihood upon graduation; both rose to top position; both, though in different ways, have been concerned with problems of education and national defense. Too young for military service in World War I, over draft age and in key executive positions in World War II, neither, apparently, has ever served in uniform.

Secretary McElroy was born in Berea, Ohio, October 30, 1904, son of Malcolm Ross and Susie Harriet (Hosler) McElroy. Each parent was at one time a school teacher. Young McElroy, on being graduated from high school in Cincinnati, won a scholarship to Harvard University where he majored in economics, earning an A.B. degree in 1925. He then joined the advertising department of Procter & Gamble Company of Cincinnati. Rising steadily in the Company through the Advertising and Promotion Department route, he became the Company's Vice President and General Manager in 1946 and President in 1949.

Much interested in education, Secretary McElroy came to public attention in 1955 when he was appointed Chairman of the White House Conference on Education held in Washington, D.C. A Director and committee member of various companies, civic and other organizations, Secretary McElroy, upon assuming his Department of Defense duties, resigned from all other activities. He was nominated last August 7, confirmed by the Senate on August 19, and sworn into office October 9.

Secretary McElroy, confronted with the current missile development problem along with the other heavy great responsibilities of his office has so far been much too busy to make a date with Pentagon studio photographers for a sitting for a posed Department of Defense photograph.

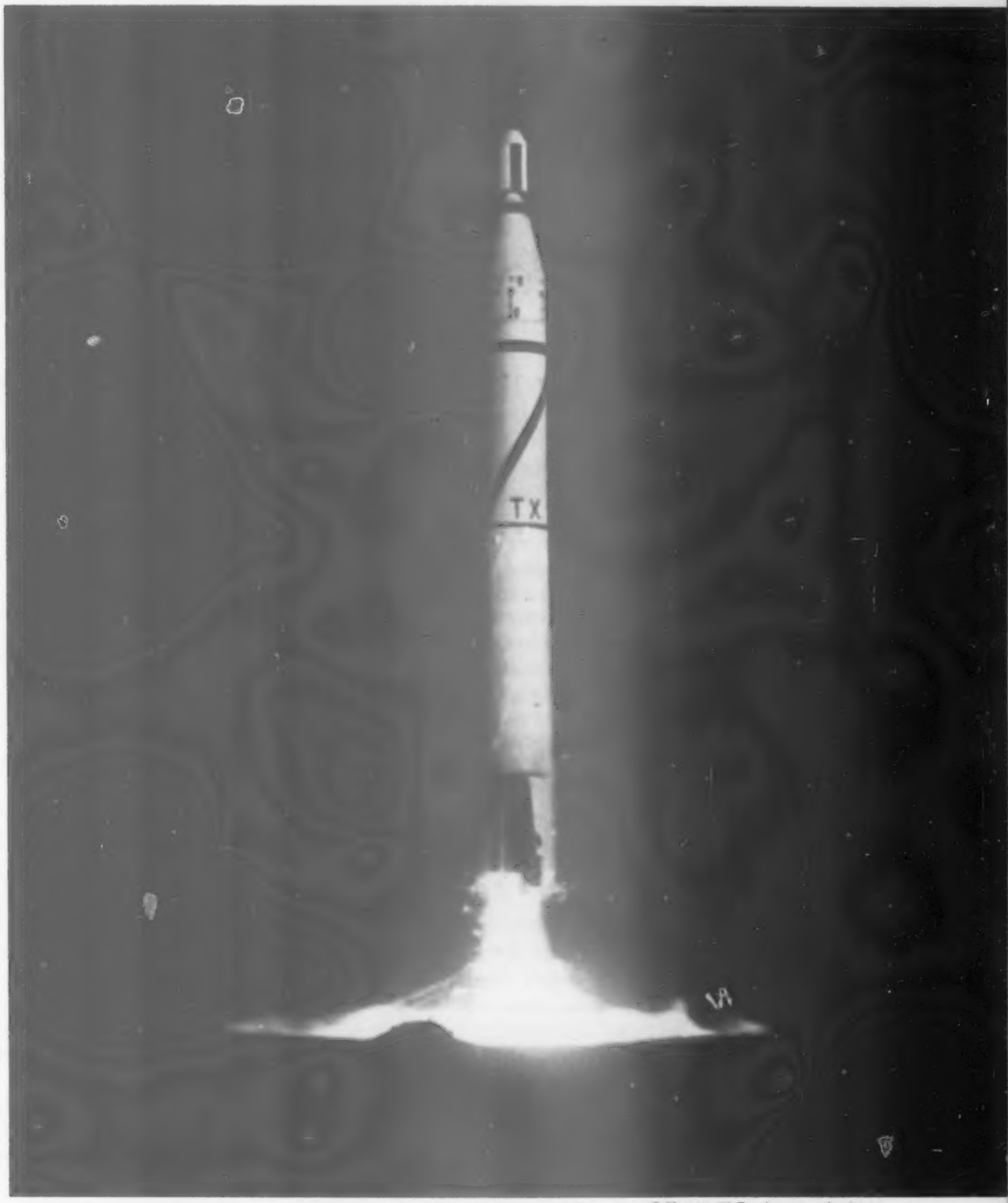
DR. KILLIAN, the President of The Massachusetts Institute of Technology, (Cambridge), appointed to the newly created near-Cabinet level office of Adviser to The President on Science and Technology, has, for some time, been widely known. He is recognized and has received many honors both as an outstanding educator and as a consultant and program administrator for scientific matters, especially in relation to national defense problems.

While immediate public interest in Dr. Killian's appointment centers on the direct bearing of his office on missile development—spurred by Sputnik—the title of his position indicates a broad assignment. Both the new office and the selection of Dr. Killian to fill it are of special interest to A.F.C.A. The government recognition thus given to science and technology tends to point up the long continued efforts of this Association—as well as other agencies— to promote an increased scientific and technical manpower potential as essential to our national defense.

The Association is also mindful that Dr. Killian, representing M.I.T., was host to the A.F.C.A. for its science symposium held at the Kresge Auditorium of the Institute during the 11th Annual Meeting of the

(Continued on page 25)

DR. JAMES R. KILLIAN, JR.
Scientific Adviser to the President
Fabian Bachrach



—Official U.S. Army photo

An Army three-stage test missile blasts off from Cape Canaveral, Florida on an August 8, 1957 test of a re-entry nose cone developed by the Army Ballistic Missile Agency, Huntsville, Alabama. The successful test proved that Army missile experts had overcome a hurdle which had balked missile scientists for years; the problem of air-friction heating when a missile re-enters the earth's heavy atmosphere.

ARMY JOINS IGY SATELLITE PROGRAM

THE SECRETARY OF DEFENSE on November 8, 1957 directed the Department of the Army to proceed with preparations for launching a scientific satellite by use of a modified JUPITER-C test vehicle.

This program supplements the VANGUARD program to place an earth satellite into orbit in connection with the International Geophysical Year.

In announcing this Army assignment for participation in the IGY satellite project, it was pointed out that all of the Project VANGUARD test firings to date had met or exceeded predicted performance. The decision to proceed with the additional program was made, it was stated, to provide a second means of putting into orbit, as part of the IGY program, a satellite carrying radio transmitters compatible with Minitrack ground stations and scientific instruments selected by the National Academy of Sciences.

Co-ordination of the Army Project in the U. S. Scientific Satellite Program is under the direction of Mr. William M. Holaday, Assistant to the Secretary of Defense for Guided Missiles.

CONTAMINABILITY OF TARGETS *and* COST OF RECLAMATION

By William M. Home,
Major Chemical Corps
Liaison Officer at U.S. Naval Radiological Defense Laboratory
San Francisco, California

MAJOR WILLIAM M. HOME

Suppose your city were subjected to heavy radiation contamination due to fall-out. What would it take in time, labor and materials to clean it up? What types of building and other surfaces are most subject to contamination? What is and is not known about such problems? Citing Navy experience, the author of this article, taking San Francisco as an example, comes up with some thought-provoking facts and figures.—Ed.

Major William M. Home served in the Infantry during World War II, was commissioned in the Regular Army as first lieutenant of Infantry in June 1947. He transferred to the Chemical Corps in November of that year. He received a Bachelor's degree in Chemical Engineering from the University of Washington in 1947 and, in post-graduate studies, earned a Master's degree in Bioradiology from University of California in 1953.

During the past five years Major Home has been engaged as a Nuclear Effects Engineer in various phases of research pertaining to the radiological problem. He is presently assigned to the Chemical Corps Research and Development Command with duty as Liaison Officer at the U.S. Naval Radiological Defense Laboratory.

INTRODUCTION

THE PROBLEM of radioactive contamination and what to do about it has been of interest to the military and civilian agencies concerned with the impact of the possible employment of nuclear weapons in any future war. Scientists, as exemplified by Dr. Edward Teller, have pointed out the fundamental hypotheses that in order to win a nuclear war the Nation must be capable of minimizing or eliminating the effects of nuclear detonations on our retaliatory and industrial capabilities, and on our way of life in general. The problem under discussion assumes the availability of high performance shelters capable of protecting a large segment of our population during the first hours, days or weeks after an attack and adequate quantities of essential materials and supplies stored to permit survival through this non-productive period.

A necessary element for national survival and winning the conflict must include the ability of the Nation to decontaminate or reclaim large areas of the country in order to recover our industrial capability. Knowledge of the interaction of contaminants with surfaces to determine the vulnerability of targets to contamination by fallout is essential.

Without definitive information concerning the contaminability of targets it would be difficult to assess realistically the cost of reclamation as measured in operating time, effort, radiation exposure, equipment and supplies. In addition, plans for radiological protection measures built into new or existing structures to render them more immune to radiological effects or to facilitate their decontamination become more meaningful. Design, procedure, effectiveness, and performance data are all closely associated with a knowledge of target contaminability to fallout.

The purpose of this paper is to discuss the importance of reliable information with respect to target contamination in terms of the associated reclamation effort Much basic data are available, but have not yet been put on a practical engineering basis.

FACTORS INFLUENCING TARGET CONTAMINABILITY

Target vulnerability to fallout is a function of several important parameters. Proper evaluation of these parameters must be made in terms of design and planning criteria for recovery procedures and in the design of structures or facilities to provide minimum vulnerability of targets to fallout. Pre-attack planning estimates, to derive realistic reclamation costs, must be based on the best information available. If planning has been too optimistic or based on unreliable information, the task of recovery may be vastly underestimated or, conversely, may be less costly than originally planned, resulting in inefficient delegation of manpower, materials and equipment.

The basic questions which are of interest to determine target vulnerability from the standpoint of radiological contamination are:

1. Does fallout contact the surface?
2. Once in contact, does it remain on the surface?
3. How tenaciously is it attached, i.e., how easily is it removed?

It should be noted that protective construction built into the more vital areas of the target complex can control the first two of these questions and influence the last to a great extent.

It it not difficult to list most of the factors which materially affect the degree to which fallout adheres to surfaces. However, the problem of weighing the influence of each to determine the magnitude of the reclamation problem before an attack has occurred is difficult. It is not realistic thinking to assume that fallout is distributed homogeneously on a uniform infinite plane or that vertical surfaces are not appreciably contaminated. This type of thinking can lead to over simplification of the problem with a resultant effect on the ability

to achieve the necessary recovery of a vital installation. A brief discussion of the important properties which can influence the deposition and retention pattern will serve to illustrate the variability associated with the fallout pattern. The ability of a tactical force and/or a civilian population to exploit this variability depends to a large extent upon knowledge we do not as yet have on contaminability.

Meteorological Conditions and Gross Target Configuration

The influence of meteorological conditions to determine the initial distribution of fallout and its resuspension and/or redistribution has been a subject for detailed study for several years. Superimposed on this general pattern, however, is the gross geometry and configuration which determines the air flow patterns around the target and/or influences the "drainage" of material from target surfaces.

The general fallout patterns predicted to indicate the iso-intensity contours do not provide the additional information required to evaluate properly the alteration of this basic pattern due to the presence of a target complex.

Detonation Conditions

The physical and chemical characteristics of the fallout are a major influence on the "flight" characteristics, the impact and retention characteristics, and the tenacity with which it is held to the surface. To a large extent the chemical state, particle size, density, etc., are a function of the conditions under which the weapon is detonated, i.e., deep water, harbor, or deep land.

For example, if the detonation is on the surface of deep water, the fallout will consist primarily of water, salts, and fission products. In this case the fission products will be in soluble and colloidal forms similar to that of the natural ocean salts. The water mass evaporates, leaving damp, sticky semi-crystalline particles that are capable of sticking on vertical surfaces. Deposition of the fallout would leave a thin film of salt on the surface, but with much of the salt and fission products adsorbed on the surfaces and absorbed into porous surfaces.

If the detonation occurs in a harbor, fallout will consist primarily of water, salt, material from the bottom of the harbor and fission products. It is probable that partial adsorption of fission products on harbor bottom material will occur. In this case the deposition on target surfaces would be in the form of a thin cake of mud.

The third type of contaminating event consists of a land surface detonation. The fallout produced will consist of a small amount of fission products attached to or fused in a large amount of finely pulverized soil in the form of a fine dust, fairly easy to remove.

Characteristics of Surface Materials

A final consideration which must be evaluated to arrive at realistic reclamation planning criteria is the physical and chemical characteristics of surface materials. Such factors as roughness, porosity, adsorbability, chemical reactivity, etc., influence the "entrapment" of fallout and ease of loosening, removal, and transport of contaminant by decontamination processes and/or natural weathering.

FIELD TEST DATA ILLUSTRATING CONTAMINABILITY CHARACTERISTICS

Various laboratory and field tests have been made of the contaminability of surface materials as related to fallout characteristics and angle of inclination. The contaminability of targets as related to micro-meteorology and geometry has not been studied directly, but some more information has been derived from experiments with other objectives. As an example, a ship was exposed to fallout from a deep water detonation. The fallout arrived in a 15 to 20 K wind on the starboard beam. The following results were obtained:

a. The contamination level (240 readings) on horizontal surfaces varied from 16 per cent to 400 per cent of the average, i.e., the largest was 25 times higher than the lowest.

b. The gamma radiation level at 3 feet above the deck varied by a factor of 10.

c. The avarage contamination level for vertical surfaces varied from the average horizontal reading as follows:

1. Forward part of the ship—40% of horiz. average
2. Aft part of the ship —20% of horiz. average
3. Lee side —10% of horiz. average
4. Windward side—Approx. equal to horiz. average

d. Test panels at the stern of the ship had an average contamination level on vertical surfaces 3 times higher than levels on horizontal surfaces.

It is apparent that such data cannot be extrapolated or used for predictions without a better understanding of all of the factors involved.

In another example, small buildings and panels of typical building materials were exposed to fallout from land detonations. The contamination levels on typical roofing materials were as much as 300 times higher than on typical wall panels—or a vertical to horizontal relationship of about 0.3 per cent. For panels of the same materials, vertical readings were about 10 per cent of the horizontal.

These two examples indicate a considerable difference in the vertical to horizontal relationships. The characteristics of the fallout appear to have had a considerable influence on this distribution. In general the land detonation normally produces a "dry" fallout composed primarily of material from the crater. One can expect masses of 3 to 300 grams of material per square foot to be associated with significant radiation levels at early times. The fallout being a dry powder has little tendency to stick on vertical surfaces. The detonation over deep water on the other hand produces fallout which is capable of sticking to vertical surfaces.

TARGET CONTAMINABILITY AND RECLAMATION

The previous sections have briefly discussed those properties of the fallout material and the surfaces with which they come in contact from the standpoint of our present capability to plan judiciously for recovery operations. As indicated, very little is known of the over-all problem of contaminability.

Should nuclear war come, the nation may well be faced with the problem of reclaiming thousands of square miles of business, residential, industrial, agricultural, and public areas. The fallout material may be easy or difficult to remove depending upon the type of fallout and also the type of surface on which it is deposited. Fully realizing that our present state of knowledge with respect to the actual distribution of the radioactive material comprising the fallout field cannot be accurately described over a given target complex, it is still possible to estimate the reclamation cost and effectiveness at least in general terms. As more definitive data as to contaminability become available the recovery operation can be planned more realistically. It would appear far wiser to plan conservatively based on present knowledge than not plan at all.

The discussion to follow concerns the factors to be

considered in such a planning process and uses the City of San Francisco, California to illustrate the order of magnitude of effort required for recovery of a target complex.

RECLAMATION TECHNIQUES

Two basic reclamation methods may be utilized: decontamination, i.e., removal; and applied shielding, i.e., burial. Decontamination consists of three operations: removal of contaminant from the surface; transporting to a non-critical location; and finally, disposal. Applied shielding primarily involves earth-moving techniques. The contaminant can be covered with a layer of clean earth, or buried by plowing or harrowing. The rate of reclamation by earth moving is influenced by soil characteristics. Standard earth moving practice has developed considerable information on this subject.

One obvious decontamination method for surfaces other than earth is to use water stream which not only dislodges the material but carries it away. If the contaminant is held tenaciously to the surface, detergents can be used with scrub brushes to help loosen the material. Other techniques such as steam cleaning, vacuum cleaning and air jet cleaning also can be used. When the material is held very tenaciously, surface removal techniques such as paint removal, sand blasting or the removal of a layer of earth by heavy equipment are used. It is important to note that if the loosened material cannot be flushed to a suitable trench or sewer, it must be collected and bulk quantities of it transported to a disposal area.

FEASIBILITY OF RECLAMATION

Considerable data have been collected regarding the effectiveness of reclamation of targets contaminated by local fallout. The feasibility of applying these methods depends upon the following considerations:

a. The time required to perform the reclamation must be short enough to make an appreciable saving in radiological exposure to mission personnel.

b. The radiation exposure to reclamation personnel must be justified by the saving in exposure of mission personnel.

c. The effort (manpower) and logistics required to reclaim the target must be compatible with the total effort available.

A study of these parameters clearly indicates that reclamation cost must be measured in terms of operating time, effort, radiation exposure, equipment, and supplies, and that it is directly associated with target contaminability.

The source of the fallout material and the surface characteristics of the target upon which it falls have been discussed in connection with the latter. A few specific examples of measured rates of decontamination will point out the importance of these factors in terms of the effort required in the recovery of a given target area. Other factors which are closely related to reclamation cost include the amount of fallout and the degree to which mechanized equipment can be used.

Source of Fallout

The rate and/or method of decontamination is influenced by the type or source of fallout, whether it be from a deep water, harbor or land detonation. A deep-water-type fallout can be removed only to an extent of about 60 per cent for a firehosing, scrubbing operation on ships, the rate being about 40 sq.ft./min. The same decontamination procedure at six times the rate of operation on a paved area contaminated by dry-land type fallout will yield a removal of about 98 per cent. To achieve an equivalent removal on the ship, a surface removal technique would be required. Typical rates of operation are about 20 ft./min. for paint stripping and about 7 ft./min. for removing a ⅛ inch thick layer of wood from the flight deck.

Amount of Fallout

The amount or mass of fallout on a surface influences the rate. This factor is of considerable importance in the case of harbor and dry-type fallout that must be transported over horizontal surfaces for considerable distances.

Table 1 shows an example of how the rate decreases with increasing masses of dry fallout for motorized flushing.

Table 1—Motorized Flushing of Dry Contaminant

Dry Fallout Gm/ft²	Rate ft²/min
10	670
33	650
100	580
330	300

The mass of fallout has no effect on the rate of operation for surface removal or earth moving techniques.

Surface Characteristics

The surface characteristics of the target influence the rate of operation. For example, rough surfaces such as wood shingles require a longer time to achieve the same degree of removal than metal surfaces.

Table 2 illustrates the influence of surface roughness on the rate of operation.

Table 2—Firehosing of Dry Contaminant

Material	Effectiveness (% removed)	Rate (ft²/min/hose)
Corrugated metal	97	65
Composition shingles	95	50
Wood shingles	89	35

DEGREE OF MECHANIZATION

The "cost" of reclamation in terms of rate of operation, effort, and radiation exposure is also a function of the degree of mechanization utilized in the reclamation effort. To indicate the magnitude of the cost variation an example is given in Table 3 comparing firehosing rate with that of motor flushing for harbor-type fallout.

Table 3—Effect of Mechanization

Criteria for Comparison	Actual Performance or Cost		
	Firehosing	Motorized Flushing	Relative Cost FH/MF
1. Operating rate/unit, hr/10^6 ft²	222	30	7.4
2. Personnel required/unit	5.5	2	2.75
3. Effort (direct labor) man hr/10^6 ft²	1210	60	20.0
4. Radiation shielding factor	1.0	0.5	2.0
5. Relative cost in radiation dose	1210	30.0	40.0

The final decision with respect to the feasibility of undertaking the recovery of a given target whether it be an entire city or some vital industrial facility within a larger area must be based on a careful analysis of all factors to finally arrive at a solution compatible with the available resources.

Table 4—Cost of Decontaminating Critical Areas of San Francisco Through Use of Available Fire Fighting and Earth Moving Equipment for Removing Slurry Contaminant.

	Firehosing			Earth Moving	
	Roofs	**Paved Surfaces**	**Sub Total**	**Land Areas**	**Grand Total**
1. Time to complete decon (24 hr. days)	16.8	11.7	28.5	13	—
2. Direct labor (No. of men)	—	—	4,000	2,800	6,800
3. Total labor, direct and support (No. of men)	—	—	6,000	4,900	10,900
4. Total effort (8 hr. man days)	101×10^3	70×10^3	171×10^3	64×10^3	235×10^3
5. Labor cost at $10/man day	—	—	$\$1.71 \times 10^6$	$\$.64 \times 10^6$	$\$2.35 \times 10^6$
6. Water required for decon (gal.)	362×10^6	314×10^6	676×10^6	—	—
7. Fuel required (gal.):					
a. Gasoline	145,000	101,000	246,000	95,000	341,000
b. Diesel fuel	—	—	—	195,000	195,000

RECLAMATION OF TARGET COMPLEX

One obvious influence on the rate of operation is the target complexity. For optimum performance, spacings between target components must be large enough to permit mechanized equipment to be used.

In order to indicate the time, manpower, and basic supplies required for recovery of a target complex the city of San Francisco, California is used as an example.

In order to simplify the problem as much as possible, the following criteria are assumed:

a. Target: City of San Francisco
b. Fallout: Harbor-type at 33 gms/ft^2
c. Area to be recovered: About 25 sq. miles consisting of
   1. All paved areas
   2. All industrial and commercial areas and buildings
   3. 50 per cent of the park areas
   4. 10 per cent of the residential areas and buildings
d. Methods: Firehosing and earth moving.

Table 4 includes an estimate of the cost of reclaiming these critical areas:

As can be seen, the reclamation is feasible in what appears to be a reasonable time. The amount of equipment required is within the capability of existing sources in San Francisco. The manpower is not too excessive considering the number of people available. The water requirements are within the capability of the normal supply. Fuel consumption is less than normal daily requirements. The greatest problem would undoubtedly be that of organizing, training, supervising and controlling 11,000 men.

It should be noted that automatic decontamination devices such as the washdown system, have as an important advantage the capability of reclamation at very

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U. S. ARMY ASSOCIATION

Third Annual Meeting

THE NEED for readiness of the Army, particularly with respect to limited wars, was stressed at the third annual meeting of the Association of the United States Army held in Washington, D. C., October 28-30.

The three-day session at the Sheraton-Park Hotel included speeches by distinguished military and civilian leaders covering a wide field of subjects of national defense concern; elaborate industrial exhibits by manufacturers of modern armament and equipment, especially in the missiles category; and again, as last year, an extensive outdoor exhibit by the Army itself at nearby Fort Myer, Virginia. Some 2000 members of the Association representing chapters throughout the nation were registered.

General Maxwell Taylor, the Army's Chief of Staff, the first speaker, told of the Army's current resources. Fourteen of its divisions, he said, have now been reorganized on the Pentomic (five battlegroup) basis, a highly mobile, flexible grouping designed to meet anticipated requirements of the atomic battlefield. He contrasted this with the situation at the time of the Association's meeting last year when, he said, this program was scarcely more than a slogan.

General Taylor dealt in some detail with the Army's missile program. He said the Nike-Hercules is coming into production on schedule. He described it as an atomic-capable antiaircraft missile, "probably the ultimate response to the manned bomber."

At the time of the meeting, Sputnik I, the first of the Russian satellites, was beeping along its world-circling orbit. Various speakers made some references to the satellite but there was neither belittlement of the Russians' scientific achievement nor any indication of dismay concerning it.

On the subject of antimissile missiles, General Taylor said, in part: "In the light of recent events, we are becoming increasingly impressed with the need to press forward in the development of the antimissile missile. The Army project in this field is, as you know, the Nike Zeus which already partially exists in the form of research and development components. All our efforts in this field have been crowned with success appropriate to the stage of the program. We see no reason why the country cannot have an antimissile missile defense for a price which is within reach. . . ."

In reviewing briefly world events of military significance during the past year General Taylor alluded to the "limited wars—in Hungary and the Middle East—in which the principal forces engaged were Army forces and in which no one has suggested the use of atomic weapons." He continued: "The events are unhappy confirmation of the view that a great atomic retaliatory force does not eliminate the danger of limited military challenges. They are a reminder of the need for great flexibility in our national force structure which, while assuring the continued possession of a powerful atomic retaliatory force, also provides the means to respond to situations such as we have seen develop in the Middle-East and elsewhere. . . ."

The concluding address of the meeting was the annual banquet speech by The Hon. Wilber M. Brucker. Secretary of the Army. It was a spirited, enthusiastic speech telling of the Army's broad field of responsibility and praising its organization and capacity.

As in some previous speeches, Secretary Brucker took occasion to allude to the Armed Services as a "defense team," stating his concentration upon the Army in this speech. "in no way implies a desire to ignore or minimize the indispensable contributions of the other Services to national defense."

Secretary Brucker quoted a previous statement of General Taylor, viz., "In its inter-service relationships the Army is a loyal member of the national defense team, resisting encroachments on its legitimate responsibilities. but scrupulously avoiding trespass on those of other services," and then continued "I join the Chief of Staff in guaranteeing to our new leader, Secretary of Defense McElroy, that the Army will always continue to live by this principle. I hope that every member of the Association will join me in carrying out this resolve. . . ."

Between these two speeches were many others of interest and concern to both military and civilian listeners. General Lauris Norstad (Air Force) Supreme Commander, Allied Powers, Europe told of the organziation and functioning of the North Atlantic Treaty Organization (NATO). Among other speakers in addition to the active duty officers of the Army on the program, were Brig. Gen. David Sarnoff, Chairman of the Board of the Radio Corporation of America. Then there was Dr. Henry Kissinger, Executive Director, International Seminar, Harvard University, and author of the widely discussed book, "Nuclear Energy and Foreign Policy," and Dr. Willard F. Libby of the Atomic Energy Commission. In all there were some 20 guest speakers on the program. Their addresses are reported fully in December 1957 issue of the Association's magazine, "Army."

At the concluding session of the meeting, Mr. John Slezak, the president, announced the adoption by the Council of Trustees of the objectives of the Association for 1958. They read as follows:

OBJECTIVES

1. An active Army of one million men as advocated by the Secretary of the Army and the Chief of Staff before a Subcommittee of the Committee on Appropriations of the House of Representatives on 5 February 1957.
2. A four-division, full strength highly mobile striking force within the Strategic Reserve.
3. Procurement of sufficient long-range airlift to move immediately and to support thereafter two divisions of this striking force under a guaranteed priority for Army use.
4. Recognition of the vital importance of the Army National Guard and Army Reserve in the structure of our national defense.
5. Establishment of provisions to protect active and reserve personnel against arbitrary force-out and other breaking of faith with their unwritten service contracts subject only to faithful and competent service.
6. Upward revision of the weight and range limitations on Army aircraft and missiles.
7. Fuller use of the Army's proven capabilities in Air Defense.
8. Passage of proposed legislation implementing the recommendations in the Cordiner Report.
9. Maintenance of the separate identity of the services and insurance that all shall have parity of expression of their views in the highest executive and legislative councils of the Federal Government.

ARMY INTEREST IN RADIATION EFFECTS ON MATERIALS AND SYSTEMS*

BY H. C. KINNE, JR.
Captain, Cml C
U.S. Army Chemical Corps
Research & Development Command

The Army interest in the field of radiation effects on material is discussed with emphasis in the following areas:

1. **The Army Reactor Program**
2. **The Food Preservation Program**
3. **Dosimetry Studies**
4. **Accelerated Aging Programs**
5. **Shielding Considerations**
6. **Army Sponsored Basic Research**

THIS paper attempts to summarize current Army interest in the field of radiation effects on materials and systems. No intent exists to present a balanced picture of Army interest as the effects on individuals are not considered, nor is much of the interest in the effects of prompt radiation from a nuclear detonation covered in any detail. This discussion will concern itself solely with the effects on materials and systems resulting from massive dosages of ionizing radiation.

This subject covers many facets of the Army structure and includes many separate fields of endeavor. All of the arms and services of our Army are deeply involved in this business and it will be impossible to assign full credit to each agency participating. Throughout this article, individual components of the Army will be mentioned in connection with their specific fields of interest but they are supported and assisted by other branches throughout the Army structure.

Needless to say, the most prevalent source of these intense radiations is the nuclear reactor, so, I shall commence with a brief description of the existing, proposed and possible future members of the Army Reactor Program. This program is under the primary cognizance of the Corps of Engineers and the first reactor we will discuss is physically located at their Engineer Research and Development Laboratories at Fort Belvoir, Virginia.

This is the Army Package Power Reactor Number One, the APPR-1. As most of you know, this reactor is in full operation, feeding electricity into the normal post supply and helping to carry the power load at this installation. This is a relatively large, pressurized water reactor which can produce some 1825 Kilowatts of electric power and is rated in terms of heat at 10 Megawatts. The reactor is designed so that all of the components fit into air deliverable packages. After assembly however, this is a permanent power installation.

A second type of reactor under development for military use is a low power, fixed plant known as the Argonne Low Power Reactor or ALPR. This type of reactor appears to lend itself to an application in connection with the Distant Early Warning or DEW line. A small, heterogeneous, boiling water reactor would be located at the end of the string of prefabricated modules that will make up the operational area and living quarters of this typical arctic installation. This plant is designed to furnish both 200 Kilowatts of electric power and 400 Kilowatts of space heating. This will afford a compact heat and power station with a minimum requirement for logistical support.

It is quite possible that similar boiling water reactors could be used for heat production alone in arctic operations. Boiling water reactors furnishing 2 Megawatts of heat and pressurized water reactors furnishing 20 Megawatts are under consideration. With the operational requirement for space heating that results from any arctic operation, this type of application could be of great value to the military establishment.

SINCE mobility is essential to the Army in any Theater of Operations, it is logical that both mobile and semi-mobile applications of reactors should be considered. It appears at first glance that such plants might be feasible if a gas-cooled reactor is coupled to a closed cycle gas turbine. This would give the dual advantages of low weight and independence of large water supplies. Developments along these lines may well lead to a portable, skid mounted reactor transported by truck trailer and dismounted for power applications. In addition, this type of reactor could be mounted on a barge

*Address given at Batelle Institute, Columbus, Ohio, October 22, 1957.

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Captain Kinne served as an infantry troop commander in the 90th Division. He attended the 9th Cml O Advanced Course at Fort McClellan in 1954-55. He spent two years in post-graduate study in Nuclear Engineering (Effects) at the U.S. Naval Postgraduate School at Monterey, California and was awarded an MS in Physics. Captain Kinne is assigned as a Nuclear Effects Engineer, Research & Development Command, U.S. Army Chemical Corps, in Washington, D.C.

if a water-borne power station were desired. Considering operations such as the Normandy beachhead or the clearing of the harbor at LeHavre during World War II, it is easy to envisage situations in which this type of a capability could be quite worthwhile.

The investigation of gas-cooled reactors for Army use is being carried out in part at Battelle Institute which currently has contracts with the Atomic Energy Commission to investigate materials for potential use in such reactors. These include investigations for cladding compounds for the fuel elements. In addition, an in-pile loop for the testing of such materials is being incorporated in the reactor facilities. Similar loops are planned for Oak Ridge, N.R.T.S. and possibly at other reactor sites as further research along these lines becomes necessary.

A semi-mobile modification of these reactors, either gas or liquid metal cooled, might be of great value in remote areas. This plant, with a capacity of several thousand Kilowatts, could be dug in for shielding by local materials and then readily moved after operation ceases. The turbines and associated equipment could be re-used at once with another reactor and this reactor might be moved successfully after a period for cooling off.

Another possible use for a small reactor would be in connection with the United States Army Transportation Corps Logistical Cargo Carrier or Sno-train. The Logistical Cargo Carrier is a multi-car, tracking vehicle operated on large, high-flotation tires and powered by individual electric motors at each wheel. With a "caboose" location for the reactor furnishing electric power for the wheel motors, this train would become almost completely independent of fuel caches and its military potential would be greatly increased. Any such application would also result in a great increase in interest in the effects of radiation on tires, axles, lubricants and the like as the reactor "caboose" should require a minimum of maintenance and afford a maximum reliability of operation under all conditions.

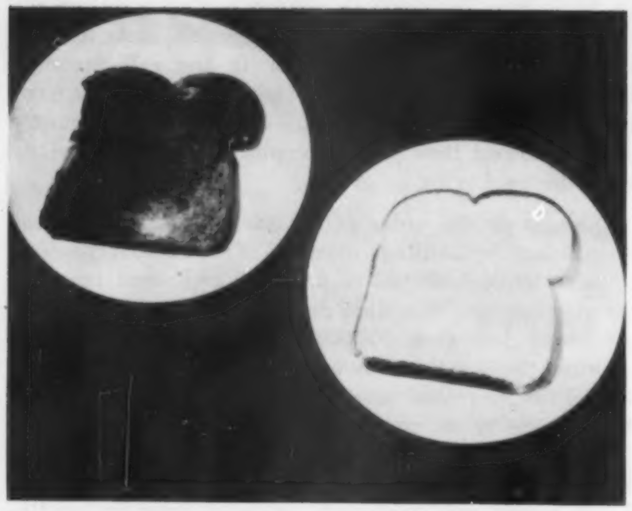
To leave the subject of reactors for a moment, I would like to discuss one subject that is near and dear to the hearts of all armies, the subject of food. We still "travel on our stomachs" and the means and methods of supplying front line troops with better and fresher foods is and always has been a prime concern of the United States Army Quartermaster Corps. To show the connection between radiation effects and foodstuffs, let me show a few pictures from the files of the Food Preservation Program of the Quartermaster Corps which may help to demonstrate the potential of ionizing radiation in the fields of preservation, storage and transportation of foods.

THIS first slide shows potatoes that have been stored at room temperatures for three months. Notice that the irradiated samples do not show sprouting while the un-irradiated controls are in bad shape. These items were almost completely sprout inhibited by a dose of 10,000 rep from a Cobalt 60 source. Dosages of approximately 10,000-20,000 rad seem to be about the lowest of value in food preservation experiments. The next higher level, that of 50,000 to 100,000 rad, is required for the deinfestation of grain. It is possible that portable Co^{60} irradiating trailers, similar to the rail mounted facility in use at Dugway Proving Ground in this program, may eventually follow the crop across the country during harvest time and accomplish deinfestation along with the packaging of grain.

Dosages on the order of 200,000 rad accomplish pasteurization by killing most of the micro-organisms present while 3,000,000 to 6,000,000 rad seem required for sterilization. This slide demonstrates mold inhibition on bread following 500,000 rep and storage for two months; these rolls received 750,000 rep and have been stored for over four months. Two million rep protected this cheese from mold for 3 months while the same dosage kept bologna and frankfurters edible and appetizing after storage without refrigeration for 4 months. These foods were packaged, air-tight, prior to irradiation and then kept without refrigeration for extended periods of time. The Quartermaster Corps has investigated some 80 candidate foods and found that many can be efficiently protected from sprouting, molding or decomposing during room temperature storage without deleterious effects on texture or flavor. Costs appear reasonable; it has been estimated that they may be on the order of a few hundredths of a cent per pound for deinfestation or sprout inhibition, ranging up to two or three cents per pound for sterilization of meats.

Sterilization studies are currently carried out at the Dugway Proving Ground of the United States Army Chemical Corps on a contract basis. Sources utilized here include a spent fuel rod in air and a 3500 curie Co^{60} source. In the future, much of this work will be accomplished at the Army Ionizing Radiation Center which is being planned for Sharpe General Depot at Lathrop, California. This facility will include a 25 Mev linear accelerator built by Varian of Palo Alto for electron sterilization, and a gamma source. The electron facility will be capable of irradiating food packages up to six inches in thickness at a two million rad sterilization dose and a production rate of 3000 pounds of food per hour. The gamma facility is under study at the present time. A two or three million curie Co^{60} source

Potatoes stored three months at room temperature. Irradiated samples at right do not show sprouting, while un-irradiated controls at left are in bad shape.



At right—irradiated slice of bread shows no deterioration in storage. At left—un-irradiated control.

or a Food Irradiation Reactor could be used. A reactor could furnish a gamma field by including a closed cycle Indium loop between the reactor core and a preservation line in the adjacent food facility. An aqueous solution of an Indium salt could be piped in a loop or loops around a conveyer belt for solid foods, or it could be pumped into a drum, similar to a heat exchanger, while liquid foods flowed through piping submerged in the Indium bath. Truly fantastic dose rates should be attainable by this method. It is intended that the facility at Sharpe act as a pilot plant for the food packaging industry and the plant has been designed so that it can be turned over to industry in the future when this form of food preservation goes on a mass production basis.

ONE of the major problems in this field is the effect of the ionizing radiation used for preservation on the packaging material used. Interactions with the material itself may have unfortunate effects on the strength, grease-proofness, transparency or porosity of the material and by-products of these interactions may adversely affect the color or taste of the packaged food. Many projects in this field are underway and a great deal of basic research has been sponsored by the Quartermaster Corps in this connection as plastic films of all types, cellulosic materials in general and all sorts of paper products could be used for this packaging. The United States Army Ordnance Corps has also been active in this field as it has been investigating the possible use of radiation to cure plastic packaging material. Ordinary methods of curing by the use of heat or pressure are not desirable for most munition packaging operations and any method of sealing or "toughening" the wrapping without the use of heat or pressure would be of great interest to the military.

Intense Army interest has been generated by the food preservation program in the field of megarad dosimetry. Any routine massive irradiation would require continual monitoring as well as some easily read device that would determine with reasonable accuracy whether or not each individual package had actually received the desired dosage. Megarad dosimetry is currently being investigated with a goal of developing three general types of dosimeters:

1. A "go-no-go" dosimeter for the megarad range, with a plus or minus 50% accuracy. Some tapes are being developed which may fit this category. These would indicate a specific dosage by an indicator color change.

2. A "production monitoring indicating dosimeter" with a 5% accuracy and,

3. A "primary standard" dosimeter for high doses with a 1 or 2% accuracy. Currently, Ceric Sulphate dosimetry is used in this application.

In connection with the linear accelerator programmed for the Army Ionizing Radiation Center, methods of electron beam dosimetry involving dose rates up to one million rad per second at energies up to 50 Mev and at power levels of 20 Kilowatts are under study. Gamma dosimetry may involve rates of one million rad per hour and energies up to 3 Mev in food preservation operations.

Other dosimetry studies currently under way within the United States Army Signal Corps and Chemical Corps entail the development of a combined gamma-neutron dosimeter. There would be an advantage to possessing a single dosimeter which would indicate the combined dosage of gamma and neutron radiation received in terms of a physical equivalent such as the rep. Current testing indicates that a simple quartz fiber dosimeter can be made sensitive to neutrons with an RBE in the vicinity of 0.5 and that this figure might be varied, if desired, by including a lining of some sort in the dosimeter tube. The Chemical Corps is developing a single phase, chemical dosimeter which can afford a range of RBE from 0.5 to approximately 3 by varying the manufacturing process. This device involves the polymerization of tri-chlor ethylene and indicates its exposure by means of an indicator color change.

THE Quartermaster Corps, in connection with the National Bureau of Standards and the Southern Regional Research Laboratory, is attempting to correlate the artificial "aging" of materials by ionizing radiation with actual aging by exposure to weather. Effects have been produced in cottons, nylon, dacron and similar materials with doses ranging from a few hundred thousand rad to one hundred million rad which compare, at least superficially, with normal aging. Agencies cooperating in this study are maintaining irradiated samples and samples exposed to weathering for continual comparison testing. If this correlation can be obtained, it may well be possible to run acceptance trials prior to large scale procurement of new items.

Shielding represents another major field of Army interest. Although these studies are primarily concerned

with the effects of the shield on the radiation, there is more and more concern with the effect of the radiation on the shield as we attempt to learn more of the basic mechanisms involved. Much of the current activity in the field concerns itself with combined shielding from both gamma and neutron radiation. Combinations of polyethylene and steel are being investigated and some work has been done on a triple encapsulation for the protection of small items. Possible combinations could include an outer-most layer of graphite dispersed in polyethylene to thermalize all neutrons impinging on the capsule, an intermediate layer of cadmium or boron powder in polyethylene to capture thermal neutrons, and an inner layer of powdered lead or tungsten in polyethylene for the absorption of gamma radiation, including gammas from isotopes produced by reactions between neutrons and impurities in the outer layers. Basic shielding data are obtained at each nuclear test with particular attention given to neutron interactions in programs run by the United States Army Chemical Corps for the Armed Forces Special Weapons Project.

The United States Army Signal Corps continually monitors work performed by other agencies on the effects of nuclear radiation on electronic devices and performs in-house studies to supplement these projects as desired. The Signal Corps Electronic Laboratories at Fort Monmouth, New Jersey issues periodic information bulletins in this field summarizing work along these lines. Additional work is performed utilizing their 2½ Mev Van de Graaff, a 250 curie Co^{60} source or the facilities of the Brookhaven National Laboratories.

An indication of the direct interest of the United States Army in this field is given by the Bulletin of Abstracts from a Symposium sponsored by the Ordnance Corps on the "Effects of Nuclear Radiations on Materials." This conference was held on 1 and 2 October 1957 at Watertown, Massachusetts at the Watertown Arsenal. Subjects of a few of the papers presented were:

- The Effects of Nuclear Radiations on Lubricants
- Gamma Radiation of Elastomers and their Monomers
- Microscopic Observation of Radiation Effects in Alkali Halides
- The Use of Nuclear Magnetic Resonance for Radiation Effect Studies
- Nuclear Radiation Effects on Materials.

INDUSTRY contracts are sponsored by many of the branches of the Army and include basic research of all types. The Quartermaster Corps alone is currently monitoring eight contracts on radiation effects on silicones, gasolines, oils, leather, anti-oxidants, glass and latex films. Polymerization studies are under way on monomer combinations to determine both threshold values and the relative effects of intermittent dosages of radiation. Preliminary results of these studies are that intermittent exposure seems to be more effective as a polymerizing agent than continuous exposure at a fixed dosage level.

The capability of the Army for in-house research on radiation effects will be greatly increased in the near future when the Ordnance Corps completes construction of its one megawatts, pressurized water, heterogeneous research reactor at Watertown Arsenal, Watertown, Massachusetts. This reactor, designed specially for research applications, will be service operated and it is intended that the early projects on its schedule will include:

- Neutron diffraction studies for determining structures of interstitials
- Free radical studies under low temperature conditions
- Radiation catalysis
- Rare earth isotope production for study of steel hardening
- Activation analysis for impurity determination.

This paper, hopefully, has given you a brief indication of the wide diversity of the Army's interest in the field of radiation effects on materials and has shown you an aggressive program in the research and development functions of the United States Army.

CONTAMINABILITY

(Continued from page 15)

early times with no expenditure of manpower or radiation exposure. Should other protective construction designed to minimize deposition of fallout and/or facilitate its removal be incorporated into the more vital areas the over-all reclamation cost would be reduced accordingly.

The importance of thorough prior planning based on realistic information cannot be over-emphasized. The magnitude of the effort involved, as illustrated by the San Francisco example, requires a concentrated study to carefully delineate reclamation priorities, location of supplies, manpower availability, and the organizational structure to carry out the recovery operation.

TRI-SERVICE COOPERATION

Results in New Mobile Gas Mask Trainer

(L to R) Captain John H. Stover, USN (MC) Commandant, Chemical-Biological School, Naval Schools Command, Treasure Island, Cal.; Major Earl R. Shappell, U.S. Army Chemical Corps Instructor, Naval Schools Command; Lt. Col. Ralph O. Heatley, U.S. Air Force Plans Officer, Western Sea Frontier.

—Official Photographs, U.S. Navy

Protective Mask Training at Dockside

U. S. NAVAL SCHOOLS COMMAND, SAN FRANCISCO, Cal.—The U.S. Navy has adopted a new protective mask (the "ND Mark V") for shipboard use. These are being distributed to the fleet and as a result a large scale training problem has arisen. Most Navy commanding officers are loath to establish a gas chamber aboard ship because of the difficulty of isolating a ship's compartment completely from the complex ventilating system—tear gas has an insidious habit of appearing in messing areas or worse, vital control spaces. Consequently most Navy gas training is done ashore when a ship is in port. Transporting the crew to a training facility having a gas chamber becomes a major operation with many valuable man hours lost.

Recently the Chemical and Biological Defense School, Naval Schools Command, Treasure Island, requested assistance from the Bureau of Naval Personnel to obtain an old and obsolete radar van as a mockup for decontamination exercises. The U.S. Air Force made such a van available. On delivery it was discovered the van — although obsolete — was in good condition. Rather than subject this vehicle to the rapid deterioration from decontamination exercises, Capt. J. H. Stover, (MC), USN, Officer in Charge of Chem Bio-School suggested the van be caulked and outfitted as a mobile tear gas chamber. With the full blessings of Captain John F. Flachsenhar, Commanding Officer, USN Schools Command, Treasure Island, this suggestion was adopted. Public Works, T.I. was able to rehabilitate the truck for only $350; Chem-Bio staff then mounted a surplus gas-driven generator to supply current for a hot plate and constructed entrance and exit ramps.

The Fleet Liaison Officer for Training Command, Pacific, was notified of this new training device and his response was immediate. The truck has enjoyed wide popularity with commanders of ships putting into the San Francisco Bay area. In its first fifteen operating days, more than 3500 men from the Fleet received chamber indoctrination with the new Mark V mask at dockside.

Operation of the vehicle is in the charge of Major Earl R. Shappell, CmlC, USA, who is a member of the staff of the Navy School. He is assisted by two chief petty officers.

It has been estimated that the gas chamber and briefing session at dockside (Mare Island Naval Shipyard; San Francisco Naval Shipyard; Naval Air Station, Alameda; Naval Supply Center, Oakland; MSTS, Fort Mason, etc.,) has resulted in saving approximately ten dollars per man and cut training time from a four-hour minimum to about forty minutes. The entire project has been received so favorably that the demand for the service threatens to exceed the capabilities of the staff of the Chem-Bio school.

An Air Force van, an Army Chemical Corps Officer and a Navy School have combined to produce a new and valuable addition to our military preparedness training as well as an outstanding example of inter-service cooperation.

THE ENGINEERING OF IDEAS

from

SCIENTIST TO TROOPS

By Robert C. Hinckley, Lt. Col., Cml. C.

U. S. Army Chemical Corps Engineering Command

Viewing the over-all mission of the U.S. Army Chemical Corps from the standpoint of the most effective use of engineering manpower, it is noted that there is a great deal in common within all technical services in the Department of the Army.

All technical services must take advantage of every opportunity to create and bring to practical field application any device, weapons system, or other piece of military materiel which will aid us in winning any future war. Let's face it, — we are in a world arms race. The fact that the U.S. Army Chemical Corps' basic mission falls within the confines of toxicological warfare doesn't change this end objective. It is true that there is no counterpart in the civilian economy to this mission. This, however, only emphasizes the necessity for the Chemical Corps to make maximum use of its engineering dollars. We receive little for free from the civilian economy in the way of engineering or engineering data which we can use. We must do our own creative thinking and take it from there. Now the problem is how to stimulate this creative thinking and bring it to fruition as quickly as possible, remembering this is a race.

Research, either basic or applied, seems to be a fairly well-understood phase of this mission. It's the creative end of this business, calling for the maximum in imagination and scientific knowledge. It should be uninhibited and thorough. The results of research are necessarily unpredictable. We're waiting for an accumulation of ideas to burst forth from the brain of a scientist into something concrete and usable. When this will happen is not predictable. Statistically we can estimate that these usable ideas are in direct proportion to the competency of the scientists and the manhours expended. The only controls, therefore, that can or should be used are based on careful selection of the scientific manpower, some limited direction in the field of applied research, and, last but not least, the allocation of the dollars to be expended.

Currently, however, we find the word "research" constantly coupled with the word "development". This usage has practically made one word of "Research and Development." Unfortunately, there is no such universal understanding about the parameters of this development phase of the overall mission. Where does the purely scientific research approach leave off and the development and applications engineering begin? Where is the decisive cut-off to be made and the idea taken away from the research mind and turned over to the applications engineer for further development into a mass reproducible practical contribution to the military arsenal?

In the civilian economy there are some concrete guide lines leading to such decisions. They are economic. A market survey will indicate whether this idea is salable and at what price. The engineers involved now have a target. Can the materiel be produced to sell at a profit? If not, the idea is shelved, at least temporarily, pending subsequent accumulation of additional knowledge. In the military, these guides are not as apparent. We don't put a price on our form of government or the lives of our military personnel. The absence of these purely economic guides, however, does not lessen the tremendous responsibility with which we are faced. We must exploit and expedite to the maximum our basic mission to produce the most effective possible materiel with which to wage war; — this is a race.

But the question still remains, — when to stop searching and start developing. When should we stop exploring data to the ninth decimal place and making marginal improvements to an idea? Here we run into some basic philosophy. As stated above, research should be uninhibited. This effort must be manned with imaginative free thinkers possessing the maximum of scientific background. This type of mind cannot be expected to be aware of all the modern methods of fabrication and synthesis available in this country to produce the idea in military quantity or quality. Furthermore, this type of mind should not be restricted by too many practical considerations. The radical or so-called impractical approach should be encouraged. These are the ideas that eventually pay off.

Let's get away from the forest, look at the trees, and admit a few generalities which have a most significant bearing on this problem.

a. The research mind is never completely satisfied with anything.

b. The research mind will continue to devote time to any financially supported project making marginal improvements long after the basic thought has been brought to a reasonably satisfactory stage of development.

c. The research mind is extremely jealous of its brain child. "Kick my blood children, but don't dare criticize my idea." "If I didn't personally think of everything worthwhile in connection with my idea, it can't amount to anything." "The suggestion that my idea could possibly be improved or changed is a personal insult."

d. The research mind resents the suggestion that the idea be removed from its jurisdiction and exploited by others; — it's like losing an old friend or having your child cared for by strangers.

THESE ARE generalities. The analysis is not directed at any individual. There is no desire here to change these people; — they shouldn't be changed. The desire here is to see how best we can live with this situation. The research mind shouldn't be expected to be a production specialist or burdened with the restrictive thinking necessary to the conservation of strategic materials and mass reproducibility of an idea. The careful preparation of drawings, specifications, and other documents necessary to accomplish procurement doesn't belong here. To place these necessary burdens on research shoulders is unfair and wasteful.

Let's get back to the fact that we are in an arms race. It is now taking too long to bring an idea from the research mind to the using troops. If the concepts outlined above have contributed to this delay, let's do something about it.

First, it is incumbent upon research management to decide the point at which a worthwhile idea has been proven. A model has either been made, no matter how crude, or sufficient data generated to prove the idea. From here on in it's a job for the engineers. We can look for troubles and delay here too. There will be trouble in transferring the basic thinking, and trouble in subduing the inventor instinct which exists in us all. Ingenuity and imagination, yes; — new invention based on an entirely new concept, no. Let's feed worthwhile entirely *new* concepts back through the research people for what they're worth but let's not bog down this current idea; — let's get it moving. Let's jump on this idea with every pair of engineering feet pertinent to the idea at hand and develop it into an item of troop issue.

This could begin with the appointment of a project engineer, preferably a man who has been working with the research people on this idea. It's his job to bring to the engineering group the basic thinking, model, or data on the idea. The engineering group will consist of specialty engineers who will work on the idea. This is to be a working group of engineers, — the men who are going to refine the design, prepare engineering drawings, write engineering specifications, engineer the package or packing, write technical manuals; — in short, prepare a procurement package from which to buy the idea for final engineering tests. The design group will also contain a maintenance engineer, a human engineer, a plants or processing engineer, and such other specialty engineers as are applicable to the problem. These engineers should have background and experience which will bring to the idea the mass-reproducible concept, the hard-boiled concept of making the idea work using modern industrial methods. They must be acquainted with that segment of industry best suited to help in this area. They must understand what is available in industry to fabricate or synthesize the idea. They must know what is standard off-the-shelf material which can be used. American industry has too often, first been amused at fulfilling some of the military's slightly off-standard requirements at an exorbitant profit, and, secondly, infuriated, (as taxpayers) when they observe that there is already in existence a standard off-the-shelf item which is actually superior for the use intended.

DEFENSE IS big business and its here to stay long into the foreseeable future. It behooves us in the military to bring big business and modern industrial engineering knowledge to bear *early* in the accomplishment of our basic mission in this area of engineering development. The race cannot be won without industry's "know-how" and plant.

Based upon the foregoing philosophy, the U.S. Army Chemical Corps has suitably organized its manpower for the fulfillment of its technical mission. This organization has taken place slowly, over a period of years, and has been given time to adjust itself between phases.

First, came an organization known as the Engineering Agency in 1951. It has been said that it was a "necessity being the mother of invention" organization. Engineers were scarce then and steadily becoming more so. It was believed that by concentrating the engineering work load of the Corps in one organization these engineers could be more efficiently utilized. But even at this early date there was a realization of the many additional advantages to be gained by the creation of such an organization.

The mission of the Engineering Agency was, in brief, to become a bridge between the research approach and the supply responsibility. The first step was for this Agency to take over complete responsibility for all drawings and specifications used by the U.S. Army Chemical Corps. This placed in the hands of a strong engineering organization the opportunity to accomplish a number of actions, viz.,—

1. Engineer all existing items and new items as they come into the system for mass reproducibility of design, and conservation of strategically critical raw materials.

2. Perform an unbiased engineering review of all requests for changes to drawings and specifications coming from either industrial contractors or government facilities.

3. Coordinate with industry in the preparation of all specifications and drawings, making sure that all engineering concepts are in step with modern industrial practices.

4. Furnish associate project engineers to work with the research elements in the early stages of the idea. This assured the Engineering Agency of an understanding of the basic thinking, obtained answers to knowledge requirements of other elements of the Agency, and assured a smooth transition when the engineering responsibility was eventually turned over to the Agency.

5. Furnish an overall engineering service to all elements of the Chemical Corps on an on-call basis.

The Engineering Agency when set up in 1951 was a subordinate command to an over-all Research and Engineering Command. Its personnel developed, became seasoned to its mission — the organization concept was working, ideas were getting into the hands of the using troops on an accelerated basis.

ON MARCH 12, 1955, the U.S. Army Chief Chemical Officer, Major General William M. Creasy, appointed an AdHoc Committee. In its charter, the committee was given the following general assignment: "To study and evaluate the current mission assignments to the Chemical Corps and the existing organization structure and relationships, to make recommendations for mission change and for the optimum organization structure within which the Chemical Corps could most effectively accomplish its mission."

After six months of work this unbiased committee of prominent industrialists and scientists recommended

among other things that the Engineering Agency become the Engineering Command, one of the four principal Commands within the Chemical Corps. On January 1, 1956, this was accomplished by order. This increase in stature, from a subordinate Command to a principal operating agency of the Chemical Corps accomplished two very important results:

1. It placed these engineers high enough in the echelons of command to bring the necessary weight to bear to attain maximum results from their efforts.

2. By placing these engineers in the first echelon of command under the Chief Chemical Officer it gave the Chief a great deal of flexibility in directing their use to the best advantage.

The Chemical Corps has a highly technical mission. The maximum use of its limited engineering talent is more than important — it's imperative.

These two important exterior results were accompanied by many interior benefits. Prestige was increased. We all perform better when we are in faster company and man cannot live by bread alone. The increased responsibility entitled these engineers to higher job ratings. This meant a modest increase in the average income of these people. This, in turn, resulted in more satisfactory recruitment in the highly competitive labor market for engineering talent. The conservation of engineering skills was maintained by retaining the principal engineering talent of the Chemical Corps within one organization. Relationships with the Chemical Corps elements at each end of the bridge (Development Laboratories and Production) were improved. At Command level full responsibility for not only technical interpretation and improvement, but protection of the design of all Chemical Corps materiel was definitely fixed. The use of the engineers of the Engineering Command by other elements of the Chemical Corps as technical assistants or consultants has come into its own.

The proof of the workability of this approach is best illustrated by these most salient facts. A large staff section has been eliminated from the Chemical Corps organizational structure. The Engineering Command, in addition to its increased effectiveness and enlarged mission, has operated for over one year with *no* additional personnel beyond that employed by the Engineering Agency.

The engineering of ideas of scientists into materiel of modern warfare into the hands of the troops is being expedited.

NEW DEFENSE APPOINTMENTS

(Continued from page 10)

Association in the Boston Area in June 1956. On that occasion, in addition to his remarks of welcome, he contributed substantially to the program.

As an educator Dr. Killian is noted as a vehement spokesman in behalf of better public schools, more emphasis on science, higher standards in the training of engineers and greater attention to basic research. He has warned repeatedly that Russian capabilities in science and technology have reached a high level.

Dr. Killian was born in Blacksburg, South Carolina, July 24, 1904. He was educated at the High School of Thompson, Georgia, and the McCallie School of Chattanooga, Tennessee; attended Trinity College at Durham, North Carolina which later became Duke University, and then transferred to M.I.T. where he was graduated in 1926 with the degree of Bachelor of Science in Business and Engineering Administration. On graduation he joined the staff of the Institute's magazine, "The Technology Review"—later became its editor. He served an "apprenticeship" under the late Dr. Karl T. Compton while Dr. Compton was President of M.I.T. In 1939 he became Dr. Compton's executive assistant and during much of the war period shouldered the burden of the Institute's administration, while Dr. Compton, one of the outstanding scientific leaders of the period, was away in connection with scientific problems connected with the war effort.

Dr. Killian has been awarded the President's Certificate of Merit and has received various other United States and foreign honors. A long list of colleges and universities have awarded him honorary doctorate degrees. Harvard, awarding him an L.L.D. in 1950 stated in its citation: "a genius in administration, whose talents serve a preeminent institution; we are grateful for his emphasis on close cooperation between the two Cambridge communities of scholars."

The ground arms and their supporting forces are of undiminished importance in this atomic age. Destructive though war has become, its objective is still decision—not destruction. That decision remains in the hands of soldiers who can finally come to grips with an enemy, defeat him, and exercise an effective control over him.

This country's first ballistic-type atomic guided missile, the Army's Corporal, has been operational since 1953. Packing a power punch of better than 75 miles, just four Corporal battalions have more firepower than all World War II U. S. artillery units combined.

GEN. CREASY

(Continued from page 8)

Many of you here are well acquainted with the characteristics of the chemical and biological munitions, particularly those who have worked closely with the Army Chemical Corps and have done so much to assist it in solving some of the heavy problems with which we have been confronted. You, therefore, are better able to appreciate that much needs to be done in perfecting our defenses and capabilities. You also are aware that much more needs to be done in apprasing the general public of the realities of chemical and biological warfare.

Example of Tactical Use

We must realize that the characteristics of toxicological weapons may have great appeal for an enemy aggressor. Consider for instance the circumstances in the Pacific Islands in the last World War where defending forces were well intrenched.

One such island was less than a square-mile of sandy soil inhabited by some 4,000 defending troops who had built a fine airstrip which we could use. We needed that island as a stepping-stone. Before our troops stormed ashore, approximately 3,150 tons of high explosives—an average of 2.6 pounds per square yard—hit the island. Despite this tremendous bombardment by ships and planes, it took us four days and nearly 4,000 American casualties to take that island. And, then, we had to rebuild the airstrip.

We, of course, did not use gas in World War II and we have no exact knowledge of what the effect would be if gas were used in a similar situation by an attacking force. Purely as a paper exercise, however, one can calculate that if the situation on that island were duplicated under conditions where some other attacking force had no hesitation about the use of chemical agents to pave the way for a landing, the results could have been entirely different. . . .

As shown by this example—and there are many others, the agents which compose the chemical and biological warfare family offer too many attractions to an enemy to be dismissed lightly in considerations affecting our national defense.

We cannot skip over the fact that an enemy bent upon total conquest could not be expected to neglect the use of any means which would serve his ends. If an enemy felt that it might be possible to render us impotent as a fighting force, but at the same time preserve our industry for his own future use, what assurance do we have that he would neglect the use of any means that would make this possible? We have none, and for this reason the chemical and biological weapons take on a new meaning in any forecasts of the types of warfare an enemy may be considering for possible use against this country.

We must also include the field of radiological warfare—and by this we mean the intentional scattering of radioactive material, such as dust, for instance, on a specific target. The effects would be the same as those resulting from the natural "fall-out" cloud of a nuclear detonation. And, like chemical and biological warfare, the effect could vary from temporary illness to death, depending upon the amount of radiation to which a victim were subject.

Advantages of CBR Means

What are some of the principal advantages of these systems—chemical, biological, and radiological—which might lead an aggressor to select them? Many of you know that these agents have much in common: they cannot ordinarily be detected by the human sensory organs; they can circumvent—or in the case of radioactivity penetrate—normal means of protection against the more common explosive type munitions. They are flexible in that the user can control the effects upon the victims through the choice of an agent which may merely incapacitate, or which may kill. While other forms of warfare cause casualties by painful blows or wounds, the toxicological agents can often perform their debilitating action without the victim being aware of it. They cause no destruction of buildings or machines. While a rifle bullet or a high explosive munition loses its effectiveness within seconds after being set in action, the toxicological munitions may pose a health problem for varying periods of time ranging from minutes to days.

The latter would be particularly true in the case of the biological weapons. These weapons could be particularly attractive to an enemy aggressor for use in a softening up process before any actual attack was launched. They can be ideal sabotage agents. Here, you can let your imagination run wild. The air conditioning and ventilating systems of large buildings are ideal methods of distributing these agents to large numbers of people. Sabotage could be far reaching in its effects by distribution through our enormous food processing system.

Possible Dangers in Food Industry

On this point I should like to quote from a highly significant report to the Food and Drug Administration by the Civil Defense Foods Advisory Committee of the National Academy of Sciences as follows:

"The food processing, transportation, and warehousing industries are aware of the possibility of overt attack and the results of Radiological Warfare (RW) because of Civil Defense activity and general publicity. These industries, however, are generally unaware of the serious possibilities or results of covert attack involving the use of Biological or Chemical Warfare. . . .

"The fact that the food industries are unaware of the hazard of covert use of chemical, biological and/or radiological warfare, and that the Federal Civil Defense Administration and other agencies are unfamiliar with the complexities of food processing, makes the problem of the covert use of CBR warfare agents acute and serious.

"Under present conditions of food manufacture, packing and distribution, it would be possible to contaminate sufficient food with biological or chemical agents or possible radiological warfare agents to impair the health or endanger the lives of large numbers of people scattered over wide areas in the USA."

In addition, to the ease with which biological agents can be distributed, there is also the fact that an enemy saboteur can set up for business in a very short time in almost any hidden location. He could pack all the apparatus he needs in one suitcase.

Our defensive problems must also be concerned with the possibility of overt military delivery of biological agents from suitable disseminating devices. It should be no more difficult to deliver such devices than other weapons. The same delivery vehicles—aircraft, submarines or guided missiles could be used. If it is possible for an enemy to drop an atomic bomb on a city, it should be equally possible to disseminate a cloud of biological agent over that city.

Summarizes Defense Needs

The development of means of defense against CBR munitions is an important phase of the work of the Army Chemical Corps. As a companion to defense, we, of course, are most intimately concerned with the dedelopment of methods for the direct use of CBR weapons should an enemy decide to use them first.

When feasible, ideas and items developed by the Chemical Corps for use in defense against the CBR agents also are made available to the Federal Civil Defense Administration for adaptation to civilian use.

Recent developments include methods for detecting the presence of nerve gases in the air. We also have developed the means for detecting and identifying disease germs much more rapidly than heretofore. Another development is a material which can be used in masks and shelters to filter out air contaminated by chemical agents, germs, and radioactive dust from the air. We recently announced the development of a new mask for troops which filters out the CBR agents. A mask using the same principle has been developed for the Civil Defense Administration. There are many other developments for the protection of both military troops and the civilian population. We are constantly working on the problem of immunization against diseases that might be used in biological warfare attack. There is a great deal more to be done.

To sum up the thoughts that I want to leave with you:

First, there must be a general realization that the CBR weapons pose a hazard to our national welfare just as do the nuclear weapons.

Second, we must strip all mystery from these munitions so that our understanding of their nature will not be clouded.

Third, defense measures which the Corps has developed for military use must, wherever feasible, be incorporated into our civil defense planning.

Fourth, we must achieve and maintain strength in the CBR warfare field to such an extent that an aggressor will not be tempted to use them against us.

To some of you here, what I have told you is not new, as I have, during my tenure as Army Chief Chemical Officer, taken advantage of every opportunity to impress these facts upon my audiences. They cannot be repeated too often. The job of education will not be completed until the public knows as much about the realities of CBR warfare and defenses against it, as it does about atomic warfare.

I believe you recognize that much of this educational job can be done effectively by people and groups outside of the official military family such as you here, who, because of your close relationship with the Chemical Corps, are better informed on these subjects than most. I hope that you will continue to take full advantage of your knowledge and seize upon any opportunities that may arise to assist in disseminating the facts to the public.

Discusses Expenditure Reductions

I am going to add a footnote to my talk because I know many of you have questions in your minds about what is happening in the Corps in light of the current pressure for expenditure reductions.

The Army, as you know, has taken some severe cuts in both manpower and in money available for procurement. The Chemical Corps, of course, must absorb its share. We will be required to operate on a much tighter budget and this will mean not only that we will not be able to do all the things that we feel are necessary, but we will have to curtail a number of projects. It will be necessary to conduct a continuing examination of all phases of our program to insure maximum accomplishment of our mission with the many resources available to us.

We do not feel, however, that these budget reductions discriminate in any way against the Corps or that we are taking more than our proportionate share. Budget cuts are affecting all elements of the Army.

We do not yet have all the details of what our actual reductions will be, but we know that we shall have several million dollars less for production and procurement and for research and development. The reduction is being particularly emphasized in such areas as installation support, depot operations, procurement, and industrial mobilization, with corresponding reduction in personnel.

In other areas—the Phosphate Development Works at Sheffield, Alabama, is being laid away and related operations at Rocky Mountain Arsenal are being curtailed. Operations at Pine Bluff Arsenal also are being reduced in some areas. One of our major operations at Detrick is being eliminated.

Now that I have given you the bad news, I am glad to say that there is some good news to go with it . . . I am somewhat limited in what I can tell you . . .

I can mention that the Chemical Corps has made significant progress in munitions development. As in the past, much of the work on research and techniques in this area will be performed in cooperation with industry and contracts are proposed for further development on delivery systems.

Some New Tasks Assigned Corps

The Chemical Corps has recently been assigned complete development and logistics responsibility for incendiary rockets. . . . There is currently under development, for which we will assume responsibility—a new flame rocket. Development of the flame warheads is near completion while some details of the rocket mortar and launching equipment to permit desired ranges and logistic simplicity need further work.

The 4.2 Mortar, originally developed by the Chemical Corps, has been assigned a permanent place in the Army weapons family, and we have been given responsibility for the development of chemical munitions for use with it.

The Corps has established an enviable safety record which has been made possible through the development of safety techniques, protective measures and equipment, many of them unique. We have had to pioneer in many aspects of our safety program. . . . In recognition of our achievements in the safety field, we have been given responsibility for the disposal of all radioactive waste for the Army and the development of equipment for the protection of personnel who handle radioactive material.

There is under consideration now the possibility of assignment of responsibility to the Corps for the procurement of all chemicals for the Army. This will involve the expenditure of many millions of dollars . . . one item alone involves the annual expenditure of approximately three million dollars.

Our district procurement offices at Boston, Atlanta and Dallas have been discontinued as such. In their stead we have field liaison representatives with small staffs at these places. . . . The Chicago office has been reduced in size and will be concerned largely with planning and liaison work. No major changes in the New York procurement office are planned.

Regrettably, it is necessary to release a good many of our people who have been concerned with the activities which are being reduced, including a few on our scientific staffs. We are also losing a number of our officers under the Army's military personnel reduction program.

On this point I should like to point out that the release of these people is in no way a reflection on their abilities. They face removal . . . because their specific skills fall within a category where first priority must be given in the reduction in force. . . .

SUCCESS OF THE

E S P P Program

AT MUSCLE SHOALS, ALABAMA

Former Enlisted Scientific and Professional Personnel Report their Views in Letters to the Author of this Article

By Serge Tonetti, Lt. Col., Cml.C.
Commanding Officer
U. S. Army Chemical Corps Phosphate Development Works

Every one in practically every field of endeavor is acutely aware of the critical shortage of scientific and professional personnel with which we are faced today and the efforts being made to increase, conserve and stretch-out this precious resource. Everlasting credit belongs to those persons from universities, industry and technical societies who in coordination with U. S. Army personnel were responsible for the initiation of the Enlisted Scientific and Professional Personnel (ESPP) Program as set out in Army Regulation 611-211.

Since the inception of this program, the Army Chemical Corps has had thousands of ESPPs assigned to its many technical activities. The author has been personally associated with about two hundred of these men during the past ten years in various assignments. Undoubtedly, as in all programs dealing with large numbers of personnel, mal-assignments and improper utilization have occurred. In some cases, this relatively minor number of mistakes has resulted in unfair criticism of the ESPP program as a whole. Unfortunately, those ESPP's who are satisfied with their work seldom write regarding the merits of the program.

Within the Chemical Corps, the contributions made by the ESPPs is generally recognized and needs no further affirmation on my part. It would appear appropriate, however, for the many AFCA industrial members to see what former ESPPs have to say about the program, hence this article.

The U. S. Army Chemical Corps Phosphate Development Works (PDW) at Muscle Shoals, Ala., was completed in 1953 and proofing operations were initiated. It was soon apparent that shake-down tests would entail much more engineering personnel than originally anticipated. Obviously, the Chemical Corps was not in a position to recruit a large group of engineers from the open market because of the already existing shortage, the higher civilian salaries being offered and the temporary nature of the PDW requirements.

In a previous article, September-October 1956, issue AFCA Journal, Colonel Tonetti outlined the role of the Chemical Corps Phosphate Development Works in support of the nerve gas program and the successes achieved by the Army Chemical Corps-TVA-Industry team associated with the Works at Muscle Shoals, Alabama.

Accordingly, Major-General William M. Creasy, Chief Chemical Officer (then Commanding General, Research and Engineering Command), decided to assemble a large group of ESPPs, with previous industrial experience, along with a small number of senior Civil Service engineers from Army Chemical Center to supplement the existing PDW staff. Since the inception of the ESPP program at PDW, approximately one hundred and fifty have been utilized. Maximum strength has been approximately sixty and is presently only four as the modification program draws to an end.

During the past three years the five major facilities that comprise this plant have been completely proofed. In addition, a multi-million dollar modification program has been successfully concluded. The plant's capability is now considerably above the original design. The author has no hesitancy in stating that the successes achieved at PDW would not have been possible without the Enlisted Scientific and Professional Personnel who supported all phases of the operational and modification programs.

The ESPP accomplishments at PDW are now a matter of record. As Commanding Officer, the author certainly could not qualify as an impartial observer as to the opinions of the ESPPs about our programs. Accordingly, I have written to some of the former ESPPs, who have returned to industry, asking them to speak for themselves. The following exact statements have been volunteered by the former ESPP quoted:

Dr. R. E. Emmert, Research Engineer, Engineering Department, E. I. du Pont de Nemours Company, Wilmington, Delaware

"The utilization of my technical background during my service at the Muscle Shoals Phosphate Development Works far exceeded any expectations or even hopes I might have had prior to my entry into the Army. In many instances, enlisted personnel were given more responsibility than is normally assigned engineers with comparable experience in industrial organizations. Consequently, a feeling prevailed that significant contributions to the national defense could be made by each individual along with an opportunity for professional development. It is my earnest desire that general recognition be given throughout the Armed Forces of the benefits to be derived by giving interesting and challenging problems to personnel that are disposed and equipped to handle them. This was done at Muscle Shoals."

Mr. Kelly L. Elmore, Jr., Asst. to Supt.—Major Alloys Electro Metallurgical Company, Division of Union Carbide Corporation, Marietta, Ohio.

"Someone in the Army had vision in setting up the Scientific and Professional Personnel Program. This program was near perfect in placing men, while on active duty, where their education and training could be utilized for the national defense effort. At PDW, an exceptional group of engineers and chemists were assembled and allowed to exercise their talent in producing and developing a process for a war gas. The experience every man attached to PDW gained from the fields of process development, production, corrosion, design, instrumentation, and management of a chemical plant was invaluable. I feel that every man attached to PDW as a SPP not only served his country with his ability, but also improved himself in his profession."

Mr. Charles L. Dornbusch, Plant Superintendent Ethylene Oxide-Ethylene Glycol Plant, Geismar Works, Wyandotte Chemical Corporation, Geismar, Louisiana

"The PDW ESPP has provided a double service to the United States. The U.S. Army Chemical Corps has received the services of technical men trained in colleges throughout the United States. The services of these men has meant increased production, higher yields, lower cost and a larger plant capacity to the PDW plant. In return the ESPPs have received training and experience which would be impossible to obtain in the ordinary private industrial plant. The further use of this training and experience in private industry will again benefit the country."

Mr. Robert L. Moison, Research Engineer, Engineering Department, E. I. du Pont de Nemours & Company, Wilmington, Delaware

"During my nineteen-month tour of duty with the U.S. Army Chemical Corps at the Phosphate Development Works I obtained considerable experience as a design and process engineer. Since my prior and present activities are in the field of engineering research, this Army experience was of value because of the diversification it provided. Upon entering the Army I concluded that the two years ahead of me would be practically a complete waste of time from the standpoint of my technical career. Thanks to the SPP program and the assignment given me, quite the converse is true."

Mr. LaVerne A. Stueber, Liaison Engineer, Engineering Department, Arabian-American Oil Company, Dhahran, Saudi Arabia

"I believe the PDW ESPP program is a good example of how technical personnel, such as chemists and engineers, can be utilized by the U.S. Army and at the same time giving the technical personnel a chance of gaining further industrial experience while in the Army. I know that I for one have gained valuable industrial experience at PDW and am grateful for the opportunity that was presented to me for participating in the ESPP program. The many problems that were encountered while I was in Process Engineering and in Operations not only proved to be interesting but also gave me a feeling of doing something worthwhile while I was in the Army."

Mr. Benjamin Hancock, Production Engineer, Oldbury Electrochemical Company, Niagara Falls, New York

"I cannot praise too highly the ESPP program, as it applied to me at the Phosphate Development Works. At the time I entered the service, I had had about three years' experience as a chemical engineer. My work at Muscle Shoals enabled me to continue doing work of a professional nature in my own field. The authority and responsibility granted me were at least the equivalent of what I would have had if I had remained in private industry. When I returned to industry, I could honestly say that there had been no lapse in my career. Furthermore, the friends I made and the associations I formed will always stand me in good stead."

Mr. D. L. Dunn, Field Engineer, Sales Engineering Division, Leeds & Northrup Company, Cincinnati, Ohio

"During my tenure at PDW, I served in the capacity of an Instrument Engineer. The benefits I derived, broadly speaking, were two-fold. First of all, I gained invaluable experience in the field of chemical plant instrumentation that I could never have achieved had I remained in my civilian position during the corresponding period of time. Secondly, it gave me a chance to be the 'fellow on the other side of the desk.' This experience has helped me immeasurably in my present sales engineering capacity, contacting both private and government organizations."

Mr. Edward D. Powers, Chemical Engineer, Acrilan Technical Department, the Chemstrand Corporation, Decatur, Alabama

"I feel that this program benefited both the Army Chemical Corps and those who participated in it. This program at PDW gave the technical personnel involved an opportunity to progress and develop in their chosen field. There was not only a chance to continue with previous experience but also many opportunities were realized which enabled them to broaden their background. There were actually some processes and many instances of the use of equipment which one would rarely find elsewhere. Based on observations during my tour at Muscle Shoals, my feelings are that the men engaged in this program gave fully of their technical knowledge and experience and thus the Chemical Corps benefited greatly through their utilization. The arrangement of an interview program between the men leaving the service and interested companies was another example of the consideration given the technical personnel engaged in this program. Many of the engineers contacted their future employer by this means. I personally believe that the ESPP program was a great service to both the Army and the enlisted personnel. I find the experience at PDW to be of inestimable value in my present occupation."

Mr. Charles E. Steinmetz, Group Leader, Acrilan Technical Department, The Chemistrand Corporation, Decatur, Alabama

"In general, young engineers face their period of service in the Armed Forces with grave misgivings—particularly those who have nurtured the personal attribute of non-conformity. This attribute to some large degree is a very desirable attribute for an engineer but hardly one to be emphasized for the service man. The ESPP program at PDW did much to relieve this particular stress upon the technically trained individuals who served there. Few established business ventures would have had engineers assuming responsibilities so freely delegated them at PDW. Some will decry this policy as typical Army foolishness; however, the vast majority of the work conducted by the ESPPs was well planned, well executed, and eminently successful. A tribute to the freedom from restraint upon the creative thinking of the individual and the confidence displayed in the ability of the ESPP team."

Robert R. Peck, Technical Service Engineer, Oxford Sulfite Mill, Oxford Paper Company, Rumford, Maine

"When assigned to the Phosphate Development Works as an operations engineer, I entered a field of industry totally alien to my educational and industrial background, and as such, took on a serious challenge. In my opinion, the PDW-ESPP Program provided me with two more years of valuable experience and allowed me the opportunity to develop and continually exhibit supervisory capabilities, initiative and a sense of responsibility. The PDW-ESPP Program is worthy of commendation since, in providing such opportunity to the enlisted man, the efforts of the Army Chemical Corps are brought to successful culmination, and the enlisted man is made more valuable to industry."

Mr. James J. Hodan, Research Assistant, University of Buffalo, Buffalo, New York

"I have the highest respect for the ESPP program in the manner in which it was carried out at PDW. From this program the Army derived maximum professional services while the men were gaining valuable experience. The successful

nature of this project was in my opinion due to interesting work, freedom from routine Army duties and good relations between officers and enlisted men. Personally, since my Ph.D. research at the University of Buffalo is on anti-cancer agents, the chemistry at PDW closely paralleled my work."

Mr. Francis X. Mayer, Group Leader, Esso Research Laboratories, Esso Standard Oil Company, Baton Rouge, Louisiana

"Already the experience I gained at the Phosphate Development Works is paying off. The experience I gained in this field is proving very useful in my work. At present I am head of a group working on instrument problems. I must say that the experience at PDW was probably instrumental in this appointment. The SPP program at PDW has done much to make me a better engineer and I am sure the benefits of this program will be a stepping stone for better things in the future."

Mr. James A. Arriens, Assistant Operating Supervisor, Phenolics Department, Monsanto Chemical Company, Cincinnati, Ohio

"First of all, the PDW ESPP program provided the necessary opportunity for me as a chemical engineer to remain in my field. To remain for two years out of touch with engineering principles and newly developed techniques would certainly have provided a serious drawback to my advancement with Monsanto. In place of this, we were rapidly introduced to problems in heat transfer, fluid flow and instrumentation which not only further implemented our problem solving techniques in these fields but kept us cognizant of all recent developments. In addition to the technical aspects of the position, one additional benefit was the opportunity to see 'government in action.' For those of us who had some industrial experience before entering the service, it provided a basis of comparison and more than adequately explained many of the economic actions performed by our government."

Mr. W. R. Neuendorf, Coatings Development Chemist, The Dow Chemical Company, Midland, Michigan

"Having been separated from the U.S. Army Chemical Corps for over two years, I believe that I can now fully appreciate the benefits I derived from my participation in the Scientific and Professional Personnel program. I believe that the ESPP program is one of the most mutually beneficial projects that the Armed Services has devised. The men who served in this program had the opportunity to increase their professional standing and at the same time contribute to the development of an important segment of our military power. Had this program not been in effect, these men would have been lost to the military development as well as technical civilian occupations. It was a distinct honor to serve at the Phosphate Development Works."

Mr. Wesley C. McGrew, Chemist, Analytical Division, Alcoa Research Laboratory, Aluminum Company of America, New Kensington, Pennsylvania

"The opportunity to put my prior education and experience in the field of Chemistry to such practical use as was possible at PDW during my two years of Army service was far above my wildest hopes at the time of my induction. In addition to the incalculable benefit of being able to remain active in the chemical field throughout this period, we were provided with an excellent opportunity to associate with men who had come from a great variety of chemical and engineering backgrounds, and so were able to 'widen our horizons', so to speak.

"My work in the Special Studies Lab at PDW was almost exactly along the line of my former training and interest. I like to think that the benefits were not all one-sided in favor of the Chemical Corps personnel, but that we were able to play a very large part in the successful operation of the Muscle Shoals Project, and by so doing we were of much greater service to the Army and our country than if we had spent those two years in some assignment unrelated to our experience."

STANDARDIZATION OF DESIGN DATA

By Bernhard Rogge

Chief, Design Evaluation Unit
U. S. Army Chemical Corps Engineering Command

Problems of standardization are usually difficult, and, to be really effective, should be applied at the stage of basic design to minimize the great mass of unrelated component parts when standardization is not applied.

In order better to control the basic design and to insure uniformity in materials, processes, methods, design and engineering practices, the Chemical Corps has issued the Army Chemical Corps Engineering Design Standards. These standards provide information on what to do and how to do it, or what to use and how to use it, and serve as tools for all designers and engineers in providing useful data and engineering design information which assures that Chemical Corps products reflect the latest industry developments, standard practices and experience data collected from Chemical Corps Surveillance and Field Tests.

Interchangeability of components is an important item in the Standardization Program and it is therefore necessary that the methods of achieving this be well understood. The proper application and selection of dimensions and tolerances have been described in great detail in the Chemical Corps Design Standards to famaliarize everybody with this all important and usually difficult field. For instance, the table on machining finishes versus tolerances tells at a glance what tolerance is suitable for a given machining finish and size of material. This eliminates indiscriminate selection of tolerances and finishes and puts it on a scientific basis.

Standardization is accomplished, for instance, in the Sheet Metal Section under Bend Radii. Most metal parts are bent too sharp, causing fractures and cracks, or bend radii are held to some 1/64 inch increments, in which case they are difficult to achieve due to spring back in the metal and wear on the tools. Also, if a variety of parts are produced from materials having different thicknesses, numerous dies and other tools would be required. The new Bend Radii table shows the radii to be ⅛ inch for the thinner sheets, which takes care of approximately 80 percent of items manufactured for the Chemical Corps. It is obvious that bending operations and tooling requirements can be greatly simplified and production cost lowered, plus saving in engineering and drafting time. Using standard radii results in greater uniformity and interchangeability of parts and permits use of standard tools and dies.

The above are just small instances of standardization; others are the control of width and depth of undercuts on screws, spotweld and rivet spacing, how to pick the right kind of bolt or fastener, etc.

The benefit gained from using Chemical Corps Engineering Design Standards is the reduction of time required in preparing and checking drawings, standardization of tools, fixture and checking gages; with consequent savings of money. Contractors doing work for the Chemical Corps use this as a guide in designing their items and thus achieve uniformity, quality of product and in line with Army Standardization Policy.

SCIENCE AND TECHNOLOGY DEPARTMENT

(The Journal is pleased to announce a separate Science and Technology Department of the magazine inaugurated with this issue. Technical articles which bear upon matter pertaining to national defense will be published in this section as circumstances and available space permit. It is desirable that prospective authors make advance inquiry as to subject matter and length of articles before submission of material. All articles will be subject to the reservations and provisions expressed in the policy statement on page 1 of this magazine.

—EDITOR)

THERMAL RADIATION ATTENUATING CLOUDS (TRAC)

By ELMER H. ENGQUIST
Chemical Warfare Laboratories
Army Chemical Center, Maryland

THE THERMAL radiation from an atomic explosion is one of the three major casualty producing effects. For a nominal, or 20 kiloton, atomic bomb, for example, heavy radiation casualties and very heavy blast damage occurs out to approximately one-half mile, light radiation casualties and heavy blast damage occurs out to approximately one mile and burns and fires could be expected to occur out to at least two miles. As the size of the bomb increases the range of the three casualty effects increases in proportion and the heat effect of the nuclear explosion affects an increasingly larger peripheral area around the central area which has been primarily affected by blast.

Among the early papers treating the subject is one by Dr. Hulbert, Naval Research Laboratory, outlining the possible uses of smoke in conjunction with atomic bombs. In late 1951 the Chemical Corps, as the agency of the Department of Defense, initiated a research program to evaluate the effectiveness of smoke screens in reducing the thermal radiation, or heat effect, of atomic weapons. This program was partially recommended by Project East River Report No. 1 to the Department of Defense, the National Security Resources Board, and the Federal Civil Defense Administration, prepared by the Associated Universities, Inc. and issued in January 1952. The program is commonly referred to as TRAC, Thermal Radiation Attenuating Clouds. The program implemented was concerned with complete evaluation of the potential of fog oil smoke screens as established by existing generating equipment.

This type of smoke screen is produced by heating a hydrocarbon oil to a temperature which will cause it to vaporize, and then passing it into the air where it condenses to a white fog. It is composed of fairly uniform liquid oil droplets, averaging seven-tenths microns in diameter, which have a high scattering and a low absorption coefficient for radiation in the wave lengths of interest in an atomic explosion.

The program was principally directed to reduction of the heat effects which might cause burns and initiate fires in the peripheral ring beyond the range of blast effect.

The Chemical Corps, with the cooperation of the Armed Forces Special Weapons Project and the Federal Civil Defense Administration, embarked on a five-phase program to accomplish the objectives. The phases included all steps from the theoretical analysis to logistic considerations; embracing theoretical, laboratory, and

non-atomic field tests, an atomic field test, a meteorological feasibility study on establishing smoke screens over U.S. cities, and a logistics feasibility study.

THE THEORETICAL studies were carried out by contract in the University of Michigan's Chemical Engineering Department. This study determined the scattering of radiant energy by the fog oil smoke screens commonly used by the military for screening purposes. The theoretical study considered the radiant energy spectrum as produced by the detonation of an atomic weapon, the parameters of concentration and particle size of fog oil smoke, and various relationships of the depth of the smoke screen, and orientation of the atomic bomb, the smoke screen, and the area protected. The detailed theoretical study resulted in a series of charts and graphs from which one can predict the attenuation of radiant energy as a function of smoke screen concentration, ground range, and height of weapon burst.

Experimental studies were conducted by the University of Michigan and the Chemical Corps to confirm the theoretical predictions. The University of Michigan conducted unique model studies using a water dispersion of latex spheres to simulate a smoke screen. These experiments, conducted for situations simulating airburst atomic weapons, both above and in the smoke screen, confirmed the theoretical results to within 20 to 50 per cent of the theory and provided a basis for the development of a simple method of empirically correcting the theoretical calculations. With this correction the theoretical results checked the Michigan experimental data to within plus or minus 10 per cent.

A second group of experiments were conducted at the Army Chemical Center using actual smoke screens confined within a warehouse used as a test chamber. A carbon arc was used to simulate the atomic bomb radiant energy and the attenuation was determined for various thicknesses and concentrations of smoke.

A third group of experiments was carried out at the Chemical Corps Proving Ground, Dugway, Utah. In one phase of these experiments the attenuation of solar radiation by smoke screens was determined. In the second phase high-intensity photoflash bombs, normally used for night photography, were detonated over smoke screens of varying concentrations and the reduction in radiation measured. The concentration of the smoke screen selected, 300 gallons of fog oil per square mile, is the amount required to provide visual screening of the target from overhead. It has been determined to be logistically feasible to establish such a smoke screen.

Two atomic weapons field tests of smoke screens have been conducted under this program. At operation KNOTHOLE in 1954 the results of a small-scale test were indicative of the effectiveness of fog oil smoke. At Operation TEAPOT in 1955 a smoke screen was established over an instrument line that covered the range of significant radiant exposure. In this test standard military smoke generators, modified for remote control operation, were used to establish the smoke screen during the 10

A Cloud Blanket Being Laid by Smoke Generators

minutes prior to the detonation. This test was successfully conducted. The results obtained verified the theoretical predictions and the results of non-atomic field tests for detectors oriented parallel to the ground to the degree to which the field smoke screen concentration could be estimated. The radiant exposure beneath the smoke screen was reduced by 65 to 90 per cent at various ground ranges by a concentration estimated at the equivalent of 300 to 425 gallons per square mile. The attenuation was sufficient to reduce the radiant exposure to three calories per square centimeter at the 9 pounds per square inch peak overpressure ground range. Three calories per square centimeter is the threshold for ignition of fires and for producing moderate burns. Thus, the thermal effects envelope was reduced to the range of significant blast effects. As indicated earlier such a concentration has been used by the military for visual screening purposes.

The studies conducted under this program were primarily concerned with fog oil smoke screens. Some limited studies were also conducted on carbon smokes which reduce the heat by absorption of thermal radiation rather than scattering as in the case of fog oil. Other

Portable Fog Oil Smoke Generator

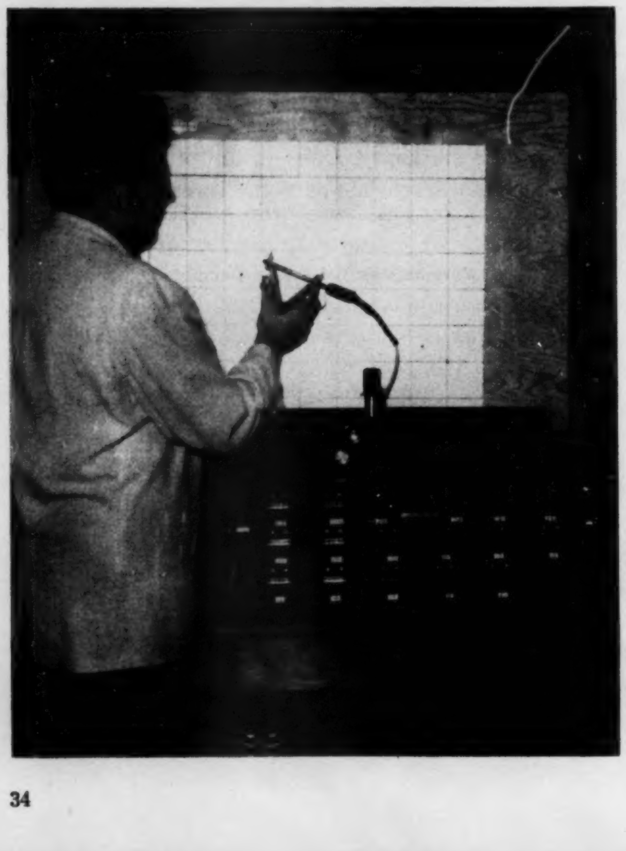
chemical smokes were also tested to insure no gaps existed in the program. The tests on carbon smokes showed them to be just as effective, and perhaps more effective, than the fog oil smokes. This indicates that "smogs" which reduce atmospheric visibility will also satisfactorily attenuate thermal radiation.

A very important consideration in this whole program is whether effective smoke screens can be set up over American cities in the event of impending attack. This meteorological feasibility study was carried out under a Chemical Corps contract by Stanford University. The meteorological data available for 106 urban areas in the United States were reviewed. It was first determined that for the majority of these cities the existing general weather data were sufficient to permit detailed analysis for smoke screening purposes and that such analyses can be carried out for less than $2,000 per city. An exhaustive study was made of the meteorological situation for four large cities. These cities were selected because their weather situations, from the viewpoint of smoke screening, were typical of potential American targets. The detailed studies showed that from two-thirds to three-fourths of the year, protective smoke screens could be established. Furthermore, the study indicated that area spacing of smoke generating equipment within the peripheral area to be screened would increase the meteorological feasibility to greater than ninety-five per cent of the time and would permit establishing adequate protective smoke screens in as short a time as fifteen minutes.

Logistics is a very important factor in considering smoke screening. Large area smoke screening is possible and has been conducted in the past. For instance, in 1943 a series of smoke screening tests was conducted in Norfolk, Virginia. In these tests an area of 40 square miles was screened under wind speeds of 8 to 28 miles per hour with an expenditure of less than 200 gallons of fog oil per hour per square mile. During World War II large scale smoke screen operations were planned for plants, cities, beach-heads, and industrial complexes. In considering TRAC, however, one is primarily concerned with screening the peripheral regions since the area immediately surrounding ground zero is subject to both nuclear radiation and blast effects. The principal consideration should, therefore, be given to smoke screening the regions beyond the range of blast effect where the thermal effect of atomic weapons is the principal cause of extending the range of effectiveness of nuclear weapons. Selected screening of vital areas in this peripheral zone, mainly subject to thermal effects, is the considered role for application of TRAC as a protective measure. Work has been conducted on remote control of smoke generators by either wire or radio. Thus, it is possible to have smoke generators permanently emplaced and operated from a central location. Such a method was used in the Nevada atomic weapons effects test of a fog oil smoke screen where the generators were turned on from seven miles away and could be turned off as desired.

NEW INVENTION FOR PARTICLE COUNT

Particle Size Counter



A new device to count and measure fog particles has been developed at the Army Chemical Corps' Chemical Warfare Laboratories, Army Chemical Center, Maryland.

Expected to prove highly useful in studies of chemical fogs and other fine particle matter, the device is also believed to have possible industrial uses. It is portable, electronically operated and semi-automatic.

With this counter, one man can measure and record, with one hand, at an average rate of 3,300 particles per hour — as compared with 1,250 particles per hour for the old method. In addition, the operator can work a full eight-hour day without undue fatigue. Using electronic calipers, the operator measures greatly magnified particle images flashed on a screen, and presses a foot pedal. This sends an electrical message to a series of small meters (like mileage indicators on cars) which record the number of each size counted.

It is expected that this counter will replace the method, now widely used, requiring two men — one measuring and the other recording. This is so tedious that ordinarily one man can work for only an hour or so at a time.

The counter was invented by Mr. Martin Memolo, an engineer at the Chemical Warfare Laboratories. He stated that while there were completely automatic counters of higher performance, one of the objections to them for Army Chemical Corps use was that they could not distinguish between droplets of moisture and other kinds of particles.

FIRST ISOLATION *of the* STEREOISOMERS OF LEWISITE

By R. MACY and T. P. DAWSON
Chemical Warfare Laboratories, Army Chemical Center, Maryland

In a chemical warfare monograph written by W. Lee Lewis, in 1919, the products of the reaction between acetylene and arsenic trichloride were given in code designation MI, MII and MIII, as follows:

$$CH{\equiv}CH + AsCl_3 \longrightarrow \begin{cases} ClCH{=}CHAsCl_2 & \text{MI} \\ (ClCH{=}CH)_2AsCl & \text{MII} \\ (ClCH{=}CH)_3As & \text{MIII} \end{cases}$$

These are now labeled LI, LII, and LIII, respectively. The important compound in this series is LI, which is lewisite, B-chlorovinyldichloroarsine.

It was recognized by Lewis that lewisite may exist in two geometrically isomeric modifications:

$H{-}C{-}AsCl_2$ $\Vert$ $H{-}C{-}Cl$	<u>cis</u>	$H{-}C{-}AsCl_2$ $\Vert$ $Cl{-}C{-}H$	<u>trans</u>

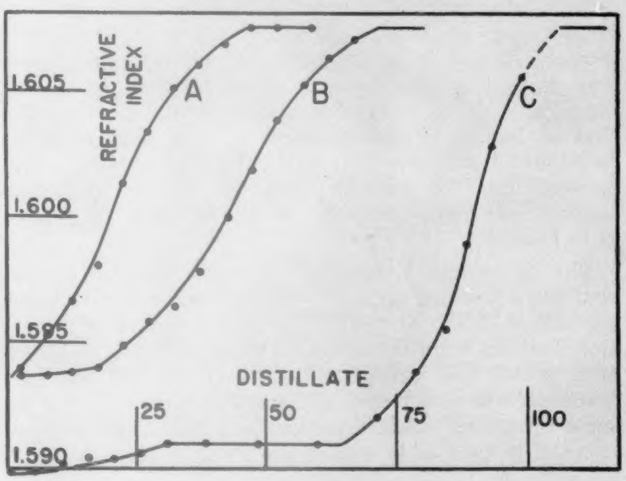
During World War I no attempt was made to determine if the LI fraction of the plant product consisted of just one compound or a mixture of the two isomers, and there is no written record that any attention was given to this phenomenon in the Chemical Corps until about 1938. Reference to the possible existence of both isomers in laboratory preparation of LI was made by Gibson and Johnson (1) in 1931, and by Zahn and Mohler (2) in 1938.

One of the principal reasons for undertaking the separation of the two lewisite isomers in these Laboratories was the interest in lowering the melting point of mustard by mixing it with lewisite. The big factor on the debit side for mustard is its high melting point (about 8° to 14.5° C. depending on purity), which militates against its use in spray dissemination. It is preferable to lower the mustard melting point by adding another vesicant to it than by adding an inert solvent such as chlorobenzene. In the preparation of a low-melting mustard with lewisite a knowledge of the melting point of the lewisite is essential, but a review of the available Chemical Corps data gave values ranging from +0.1°C. to −18°C. It seemed plausible that these discrepancies in the lewisite data may have been due to the presence of varying amounts of the two isomers in the samples used by different investigators. The lower melting lewisite isomer would be preferable for use in obtaining a lower melting mustard, provided the toxicity still resided in that isomer.

The possibility that most of the toxicity of lewisite may be due to one of the two isomers was the second reason for initiating this work. This possibility was supported by the fact that the available toxicity data were none too concordant as obtained by different groups of experimenters. This was the factor which led Dr. Duncan MacRae, the Chief Chemist of this organization as it was constituted in 1938-1940, to urge strongly that separation of the lewisite isomers be attempted.

The lewisite sample used for some of the work was distilled twice from pilot plant material according to the current CWS specification procedure, and the fraction was employed which distilled at 71-72°C./10mm. The raw material used for the distillation was made in a pilot plant in 1925. The distillate would not freeze in carbon dioxide snow. The fractionation procedure was

Fig. 1. Distillation Curves for Separation of Isomers of Lewisite (LI).
Refractive index at 25°C. (D line)
Distillate volume in ml.
Curve A. Pilot-plant grade LI (15-year old sample)
Curve B. Sample of pilot-plant LI which had been distilled in ordinary column at about 70°/10 mm.
Curve C. Composite sample of distil!ed LI, with refractive index of 1.5945.



then pursued further by using a column of the total condensation type with partial take-off, which was eventually operated at a reflux ratio of about 10 to 1, with a take-off rate of about 5 ml./hr. The distillation column was 56 cm. long and 1.7 cm. diameter, packed with glass helices, and had an efficiency of about 10 theoretical plates when tested against a mixture of carbon tetrachloride and benzene. (This type of column was still somewhat of a laboratory curiosity in 1939-1940. It was obtained from Professor M. R. Fenske of Pennsylvania State University, and referred to as the Penn State column. Several months in the winter of 1939 were spent in learning how to use it.)

In one of the early runs, in March 1940, a 93-ml. sample of the 15-year old plant grade material was put through the Penn State column. Excellent separation was obtained of arsenic trichloride from LI, and of LI from LII+LIII. There did not appear to be any halt in the temperature rise from 68° to 71° at 10 mm. during the distillation of the LI component, but fractions collected in this range were sealed for further reference. At a later time (see below) it was learned from refractive index measurements that a partial separation of the *cis, trans* isomers had actually been obtained. Refractive index measurements were not made at the time because it was thought from statements of other investigators that lewisite hydrolyzes so rapidly in a thin film on glass, and etches the glass so thoroughly, that a consecutive series of measurements could not be made on an Abbe refractometer. It was found, however, that such measurements could be made by making the readings rapidly and by rubbing down the glass prism with jeweler's rouge between readings. (After the work was done the refractometer needed factory repair!)

While the distillation work was proceeding, the organic part of the team repeated the work of Gibson and Johnson (1) who reported a freezing point of 0.1°C. for a lewisite sample which had been purified by converting it to the arsonic acid (a solid which was recrystallized from acetone to purify it) and re-converting back to lewisite. A lewisite sample, prepared in this was was easily frozen in carbon dioxide snow, and was used as seed crystals for later work. The sample had a freezing point of —2.4°C., which did not change when it was partially melted and the residual crystals then melted and the freezing point run once more. Since it appeared to be a pure isomer it was labeled LI Isomer I.

With seed crystals available, it was possible to determine the freezing point of the material resulting from an ordinary distillation of the pilot plant product, which was found to be −14.9°C. In order to find out what concentration of Isomer II in Isomer I was represented by this freezing point, a curve was obtained with solutions of benzene in Isomer I, which gave a practically straight line up to nearly 0.2 molar when freezing point was plotted against benzene concentration. From this essentially "ideal" solubility curve it could be estimated that an Isomer II concentration of 0.315 mole or 31.5% in Isomer I will give a freezing point of −14.9°C. This showed that the lewisite from the 15-year old plant sample had approximately 30 to 70 ratio of Isomer II to Isomer I.

The LI Isomer I obtained from the purified arsonic acid had a freezing point of −2.4°C. and refractive index (D line at 25°C.) of 1.6075. The sealed sample of a fraction distilled from the 93 ml. of plant material in March 1940, which had distilled just before the LII and LIII fractions, was now tested and was also found to have the same refractive index. Pure Isomer I had therefore been isolated in this early use of the Penn State column. A fraction from the start of the LI distillation range had an index of 1.5963.

Since it was apparent that the efficacy of fractionation could be followed by refractive index measurements, more careful distillation runs were made with the Penn State column to isolate the Isomer II component as pure as possible. About 120 ml. of material with an index (D line at 25°C.) of 1.5945 was obtained in a series of distillations using lewisite distilled first in an ordinary column. When this 120 ml. was used as a charge in the still-pot it yielded results as shown by curve C in Fig. 1, from which it was assumed that the refractive index for Isomer II is 1.5910 (see below for a better value from British literature).

This work was pursued only intermittently, and it was not until August and September 1940 that the conclusive distillations showing the type curve in Fig. 1 were obtained. Through established liaison channels the information was transmitted to the British chemical warfare personnel, who performed a large amount of excellent research on this problem, the bulk of which was carried out between September 1940 and April 1941 (3). In this country, however, interest rapidly subsided when it was rather quickly found that the isomers have essentially the same toxicity, and that in the newer processes for making lewisite the isomer content is more than 90% Isomer I with its relatively high freezing point.

It is a pleasant duty to round out this narrative with a tribute to the British chemists who established the properties of the two isomers with great care and worked out a method for obtaining Isomer II in a better state of purity than that reported above. Hewitt (4) found that if the mixture of isomers is converted to the two arsonic acids (as described previously in this article) the arsonic acid corresponding to Isomer I can be largely removed by simply concentrating the water solution. The lewisites in the mother liquor are now re-obtained from the arsonic acids, and when distilled a sharp separation of Isomer II from Isomer I is obtained. Pure Isomer II so prepared was reported to have a refractive index (D line at 25°C.,) of 1.5859 and freezing point of −44.7°C.

The British gave the name *iso*-lewisite to LI Isomer II, and Moelwyn-Hughes *et al* (5) showed that Isomer I is *trans* and Isomer II is *cis*. The physical constants are listed by Whiting (6).

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2. Zahn, C. T., and Mohler, H., *Helv. Chim. Acta*, 21, 1284-1296, 1938.
3. Sutton Oak Report 659, dated 20 April 1943 (not distributed).
4. Hewitt, C. L., *J. Chem. So.*, 1948, 1203.
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6. Whiting, G. H., *J. Chem. Soc.*, 1948, 1209.

The Drake, big brother of the World War II Duke, is an amphibious cargo carrier developed by the Army which unloads 5,000 pounds at shipside and delivers it at an inland supply point.

The Army, with capital assets in real estate, supplies and equipment valued at more than $52 billion, is one of the biggest business operations in the world. Its material becomes obsolescent at an annual rate of a billion dollars.

General Bradley once said that "Congress can make a man a general, but it takes communications to make him a commander." This is more than ever true in the dispersed battlefield of modern warfare.

CHEMICAL CORPS NEWS

HAROLD WALMSLEY PROMOTED TO BRIGADIER GENERAL

—U. S. Army Photo

ARMY CHEMICAL CENTER, Md., Dec. 26—The Department of the Army announced this week the promotion of Colonel Harold Walmsley, commander of the U. S. Army Chemical Center and Chemical Corps Materiel Command, to the rank of Brigadier General.

General Walmsley was notified of his promotion in a telephone call from Major General William M. Creasy, Chief Chemical Officer of the Army who called from Washington, D.C., on Christmas Eve.

When assigned to Army Chemical Center last July, General Walmsley was on duty as commanding officer of the U. S. Army Chemical Procurement Office, New York City.

Born in Darwen, Lancashire, England, General Walmsley attended high school in Stamford, Conn., before entering and assigned to Fort Detrick. After separation from active duty in 1946, he remained at Fort Detrick as a civilian employe. He is now a lieutenant colonel in the Air Force Reserve.

DETRICK SCIENTIST NAMED FOR HEALTH SERVICE POST IN PERU

Dr. John C. Wagner, U.S. Army Chemical Corps virologist and scientific administrator at Fort Detrick, Maryland, was appointed Director of the Peruvian Institute of Public Health, Lima, Peru, effective December 16.

Dr. Wagner will work under the direction of the International Cooperation Administration of the United States State Department as a reserve officer of the Public Health Service, "on loan" to the ICA.

He is the author of about 25 publications concerning virology and immunology and has presented many papers at scientific meetings. While at Fort Detrick, he received a patent for an automatic egg inoculating machine for cultivation of viral and rickettsial organisms in embryonated eggs.

A native of Danville, Pa., Dr. Wagner earned his bachelor of science degree in agricultural biochemistry at Pennsylvania State University in 1936, and a scientific doctorate in virology at Johns Hopkins University in 1947.

In 1944, Dr. Wagner was commissioned in the Army

WAC MAJOR HAM IS BRIDE OF COLONEL TINDAL, USAF

ARMY CHEMICAL CENTER, MD.—Major Winifred E. Ham, chief of the industrial security office, Office of the Chief Chemical Officer at the Army Chemical Center, was married to Colonel Lorry H. Tindal, commanding officer of the Gadsden, Alabama, Air Force Depot, on November 1. The wedding took place in the Little Church Around the Corner in New York City.

WAC Major Hazel P. Noble was maid-of-honor while Mr. Theodore Hamilton was best man.

The bride, born and educated in Massachusetts, is the daughter of Dr. William A. Ham of Boston.

The bridegroom, son of Mr. and Mrs. Andrew J. Tindal, of Holly Hill, South Carolina, is an alumnus of Clemson College.

SEMINAR ON COMPUTERS

The U.S. Army Chemical Corps Engineering Command held a seminar for all post technical personnel on 31 October 1957, at which Mr. Montgomery Phister, Computer System Division, Ramo-Wooldridge Corporation, Los Angeles, California, was guest speaker. His subject was—"Computers for On-Line Control of Chemical Processes."

DR. MORRIS S. KHARASCH

Dr. Morris S. Kharasch who had been under contract to the Chemical Corps as a Research Supervisor died on October 10, 1957 while in Copenhagen, Denmark. Colleagues at the Army Chemical Center speak of his untimely passing as a major loss to the United States and particularly the Chemical Corps.

Dr. Kharasch had a doctorate degree from the University of Chicago where he became Professor of Organic Chemistry and recently the Director of the University's Institute of Chemistry.

He first became associated with the Chemical Corps in World War I when, as an enlisted man, he was assigned to Edgewood Arsenal, Md. In the year following he made many contributions which included improved chemical compounds and methods of producing new compounds.

COLONEL ROBBINS RECEIVES CERTIFICATE OF ACHIEVEMENT

CERTIFICATE OF ACHIEVEMENT is presented to Colonel Willis G. Robbins, (left) Chemical Supply Officer by Colonel William D. Buchanan, commander of the Memphis General Depot. Colonel Robbins received the award for submitting a suggestion involving the consolidation of two chemical divisions at the Depot, which it is stated, will save the Department of the Army more than $15,000 annually.

MAJOR LINDQUIST RETIRES

Major Gerald Elmer Lindquist, Chemical Officer at Fort Eustis, Virginia, retired on November 30 after 23 years of commissioned service.

He entered on active duty from the National Guard on November 1936 as an enlisted man and received a commission as 2nd Lt. in 1944.

Major Lindquist had served in Hawaii and in the Far East and at Army Chemical Center, Maryland, as commander of a smoke generator company. He also had duty at Rocky Mountain Arsenal. His decorations include the Bronze Star Medal, the Purple Heart, the Meritorious Unit Citation, the Asiatic-Pacific Campaign Medal, and Presidential Unit Citations from the Republic of Korea and the Philippines.

NEW INSPECTOR AT EDGEWOOD

EDGEWOOD, MD. — Lieutenant Colonel Alfred F. Weirich, former executive officer, Rocky Mountain Arsenal, Denver, Colorado, has been appointed post inspector at the Army Chemical Center. He succeeds Colonel Zack M. Williams who retired on November 30.

Colonel Weirich is an alumnus of the University of Maryland, class of '29. He was employed by the Navy at Annapolis as a civil engineer before being called to active duty with the Army in 1940.

He served in Burma, India, and the Pacific area during 1944-1945, where he earned the Army Commendation Ribbon.

PROFICIENCY AWARDS

Since the November-December 1957 issue, the Journal has received announcement of additional awards for proficiency to civilian employes of the Army Chemical Corps, summarized below:

WEST POINT SCIENCE CONFERENCE — Four of twenty-two science papers which won special honors for their authors from the Army's Chief of Research and Development, at the Army Science Conference, held last June at West Point, N.Y., were presented by civilian scientists of the Chemical Corps. Recipients of the awards were:

Mr. William G. Tank, Dugway Proving Ground, *Certificate of Achievement* and $500 cash;

Dr. Arthur J. Dziemian, Chemical Warfare Laboratories, Army Chemical Center, *Certificate of Achievement* and $300;

Messrs. R. M. Acker, R. W. Hartmeyer and R. H. McQuain, Biological Warfare Laboratories, Fort Detrick, Md., and *Mr. Harvey S. Greenfield*, Dugway Proving Ground, *Certificate of Achievement*. Cash awards of $100 each were also presented to *Messrs. Acker, Hartmeyer, McQuain, and Greenfield.*

OFFICE OF THE CHIEF CHEMICAL OFFICER:

Mrs. Vauda M. Owendoff, Administrative Assistant, Office of Assistant Chief Chemical Officer for Planning and Doctrine, *Outstanding Employee Rating.*

Sustained Superior Performance awards were presented to the following:

Mr. Leo J. Arico, Supply Cataloging Supervisor, Logistics Planning Division (for duty performed while he was employed at the U.S. Army Chemical Corps Engineering Command, Army Chemical Center, Edgewood, Mr.)—also a $200 cash award.

Mr. Floyd B. Brinkley, Technical Liaison Officer—and $300 cash award.

Mr. Roger G. Coombs, Administration Division—also a $100 cash award.

Mr. G. Landon Feazell, Chief, Safety Branch, Administrative Division—also a $300 cash award.

Mrs. Clara E. Kantack, Administrative Services Branch, Administration Division—and a $100 cash award.

Mrs. Nancy C. Pavone, Military Personnel Branch, Career Management Division—and a $200 cash award.

Special Service award:

Mr. Donald Rogers, Comptroller's Office — and $300 cash.

Certificate of Achievement to *Mrs. Thelma S. Hayden*, Program Coordinating Office.

Suggestion Award to *Mr. Samuel Cohen*, Office of the Comptroller—and $20 cash.

CHEMICAL SECTION—MEMPHIS GENERAL DEPOT

Suggestion Awards to: *Miss Virginia Duncan, Mrs. Jessie Jennette, Mrs. Katherine Richert*, and *Mrs. Pauline Testerman*—joint award of $140 shared.

Mrs. Frances Busselle, $10 cash.

Mr. David Henry, $15 cash.

Mrs. Edna May, $10 cash.

Mr. Hiram Winborn, $25 cash.

COL. MILES AND MAJ. BIEGALLE HONORED ON ENDING SERVICE

FETED—Colonel Fred J. Delmore (left), President of the Chemical Corps Board, Army Chemical Center, Md., places the Army Commendation Ribbon with Metal Pendant on Colonel John L. Miles while Major Bruce C. Biegalle (right) displays a letter of appreciation, with which he was presented. Colonel Miles and Major Biegalle, terminating their military service, were feted at a luncheon recently when the citations were presented to them by Colonel Delmore. Both were assigned to the Board.

MR. LESTER J. CONKLING LISTED IN "WHO'S WHO"

EDGEWOOD, MD.—The name of Lester J. Conkling, chief of Arsenal Operations, Edgewood Arsenal, Army Chemical Center, appears in the current edition of "Who's Who."

This is just another honor added to the many Mr. Conkling has received during the 36 years he has been employed here as a chemical engineer. Among his awards are the Exceptional Service Award and Medal, which he received in 1946, and the National Service League Career Service Award in 1955.

The career service award is the highest honor to be won by a Federal employe. Mr. Conkling was one of ten selected from the more than 2,100,000 civil service employes and he was the only one employed by the Department of the Army.

Mr. Conkling came here in 1921 as an associate chemist. A graduate of Cornell University, his contributions to the Army Chemical Corps include the first solid smoke munition, irritant gas grenade, and a smoke cartridge for the .45 caliber Army pistol.

NAME ROAD AT FT. McCLELLAN IN HONOR OF LATE GEN. BAKER

A road at Ft. McClellan, Alabama, location of the Chemical Corps Training Command Hqrs., and the Chemical Corps School has been named BAKER ROAD in honor of the late Major General Walter C. Baker, former Chief of the Chemical Warfare Service of the Army.

ARMY COMMENDATION RIBBON

Announcement has been made of awards of the Army Commendation Ribbon with Metal Pendant, for meritorious service for the periods indicated, to the following:

Second Oak Leaf Cluster to the Commendation Ribbon with Metal Pendant — to *Colonel Donald G. Grothaus*, now Commanding Officer, Fort Detrick, Md., for meritorious service as commanding officer Rocky Mountain Arsenal, Denver, Colo., 1955 to 1957.

First Oak Leaf Cluster to the Commendation Ribbon with Metal Pendant—

Colonel Vincent LaPiana, July 11 1955 to June 24, 1957.

Major Robert L. Andreoli, February 1, 1956 to July 22, 1957.

Major Beatrice E. St. Helens, June 30, 1956 to November 30, 1957.

Major Clyde H. Westbrook, Jr., September 15, 1954 to July 5, 1957.

Captain David H. Maxwell, February 6, 1956 to September 6, 1957.

Army Commendation Ribbon with Metal Pendant:

Colonel R. D. Chapman, April 1, 1956 to November 9, 1956.

Lt. Col. William E. Gill, January 6, 1955 to December 13, 1957.

Lt. Colonel Allan C. Hamilton, April 23, 1956 to November 28, 1956.

Lt. Colonel Oliver R. Hertel, July 3, 1954 to July 15, 1957.

Commander Robert Holdenried, U.S. Public Health Service, July 19, 1954 to August 20, 1957.

Major Eugene J. Cronin, Jr., January 28, 1957 to July 6, 1957.

Major John Moran, November 27, 1956 to May 24, 1957.

Major Cleo M. Willoughby, August 18, 1952 to June 30, 1957.

Captain Frank B. Angorola, Jr., August 2, 1955 to July 30, 1957.

Captain Raymond E. Bell, October 8, 1954 to March 31, 1957.

Chief Warrant Officer, W2, William H. Chandler, July 8, 1954 to August 31, 1957.

Private First Class Stephen L. Hill, Jr., May 18, 1957 to July 8, 1957.

INDUSTRIAL TECHNIQUES COURSE IS INAUGURATED AT EDGEWOOD

EDGEWOOD, MD.—An educational program designed to familiarize technical personnel at the U.S. Army Chemical Corps Engineering Command here with the latest developments in manufacturing methods and techniques was initiated recently with a one-hour film presentation.

As presently envisaged, the program will consist of a series of one-hour meetings held every three or four weeks during a two-year period. The information, which will cover a wide range of technical and general interest subjects, will be presented with motion pictures provided by many industrial organizations.

Major Mary B. Warner, administrative officer of ENCOM, will direct the course with the help of Roland Brown, who will serve as technical adviser.

Colonel William J. Allen, Jr., commanding officer of ENCOM, believes that this program will promote a more thorough understanding of modern engineering techniques developed by private industry.

ing the U. S. Military Academy at West Point in 1928. During World War II he served as chemical officer of the Ninth Army in the European Theater of Operations.

General and Mrs. Walmsley have two sons—Allen 18 and Mark 5.

RETIREMENT HONORS FOR WAC MAJOR ST. HELENS

—U.S. Army Photo

Major General W. M. Creasy, Chief Chemical Officer presents the 1st Oak Leaf Cluster to the Army Commendation Ribbon to Major Beatrice E. St. Helens, Career Management Division, in ceremony held at Building T-7, Gravelly Point, Va.

Major Beatrice E. St. Helens, WAC Staff Adviser to the U.S. Army Chemical Corps, was one of a group of Army personnel in the Washington area honored on the occasion of their retirement with a retreat parade at Fort Myer, Va., on Wednesday, November 27, 1957. Major St. Helens completed 15 years of active service on November 30. Troops of the First Battle Group, Third Infantry (The Old Guard), and the U.S. Army Band rendered military honors and passed in review before the retiring group at the Ft. Myer ceremony.

Prior to the retirement ceremonies, on November 22, Major General William M. Creasy, Chief Chemical Officer, Mrs. Creasy and members of the Chemical Corps and WAC Headquarters staffs feted Major St. Helens at a party at Ft. Leslie J. McNair.

Letters of commendation were received by Major St. Helens from Colonel Mary Louise Milligan, Director of the Women's Army Corps, and Lt. Colonel Luta C. McGrath, WAC Staff Adviser.

Major St. Helens entered the WAC from Kansas in November 1942, was commissioned in September 1943 and attained her present grade of Major (Regular Army) in December 1948. She has served as Recruiting Officer, Supply Officer, Instructor and Company Commander, and as Procurement Division Director at U.S. Armed Forces Institute, Madison, Wisconsin. She also served in Europe as Information and Education Officer.

Major St. Helens received the Army Certificate of Appreciation of her services and on November 29 was awarded the First Oak Leaf Cluster to the Commendation Ribbon with Metal Pendant for meritorious service. Her home-town is Independence, Kansas.

HEADS DETRICK DIVISION

FREDERICK, MD.—Donald W. Falconer, of 1201 Pinewood Drive, Frederick, Md., was recently designated as chief of Munitions Development division, Army Chemical Corps Biological Laboratories, Fort Detrick, Maryland. Mr. Falconer, who served in the Chemical Corps in World War II, is now a Major in the Reserve. He is a graduate of the College of Wooster, Ohio, class of 1935, where he received a BA degree. A design engineer, he is a member of the Sigma Pi Sigma, honorary physics society, and the Research Society of America, Fort Detrick chapter.

COL. WILLIAMS RETIRES

EDGEWOOD, Md. — Colonel Zack M. Williams, Post Inspector, concluded his Army career here on November 30 after more than 16 years of active duty.

An alumnus of the University of North Carolina, class of '28, he taught in North Carolina high schools for several years before becoming Educational Adviser in two Civilian Conservation Corps districts during the early 1930's. He was commissioned in the Army in 1935, and, during World War II, he served 32 months in the European-African-Middle Eastern Theater, first as a Chemical Officer and later as Provost Marshal. He was integrated into the Regular Army in 1947, returned overseas and served 30 months with the Military Government in Japan.

Colonel and Mrs. Williams will make their home in Deland, Florida.

'$64,000' SAFETY QUESTION

Mr. William H. English, Army Chemical Center safety officer, has devised an unique means of stressing safety-mindedness to post personnel—it is a small black box that reads "Open the safe to find the answer to the $64,000 safety question." When opened, and an individual looks inside, he looking straight at himself—at a mirror, that is. Mr. English emphasizes that each one of us is the answer to the big safety question that confronts the nation today. The exhibit will be rotated throughout the post installations.

As military equipment becomes more complex it also becomes obsolete sooner. For bulk calculations the Army uses 14 years as the average life of an item from first production to obsoletion. Items such as guided missiles for which the state of the art is advancing rapidly will have a more rapid rate of obsolescence.

The system now in use at the Army Signal Supply Agency in Philadelphia and four branch depots determines in a single day the status of all the 150,000 line items carried in stock. Before the day of electronic data processing systems this task took as long as six months.


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